

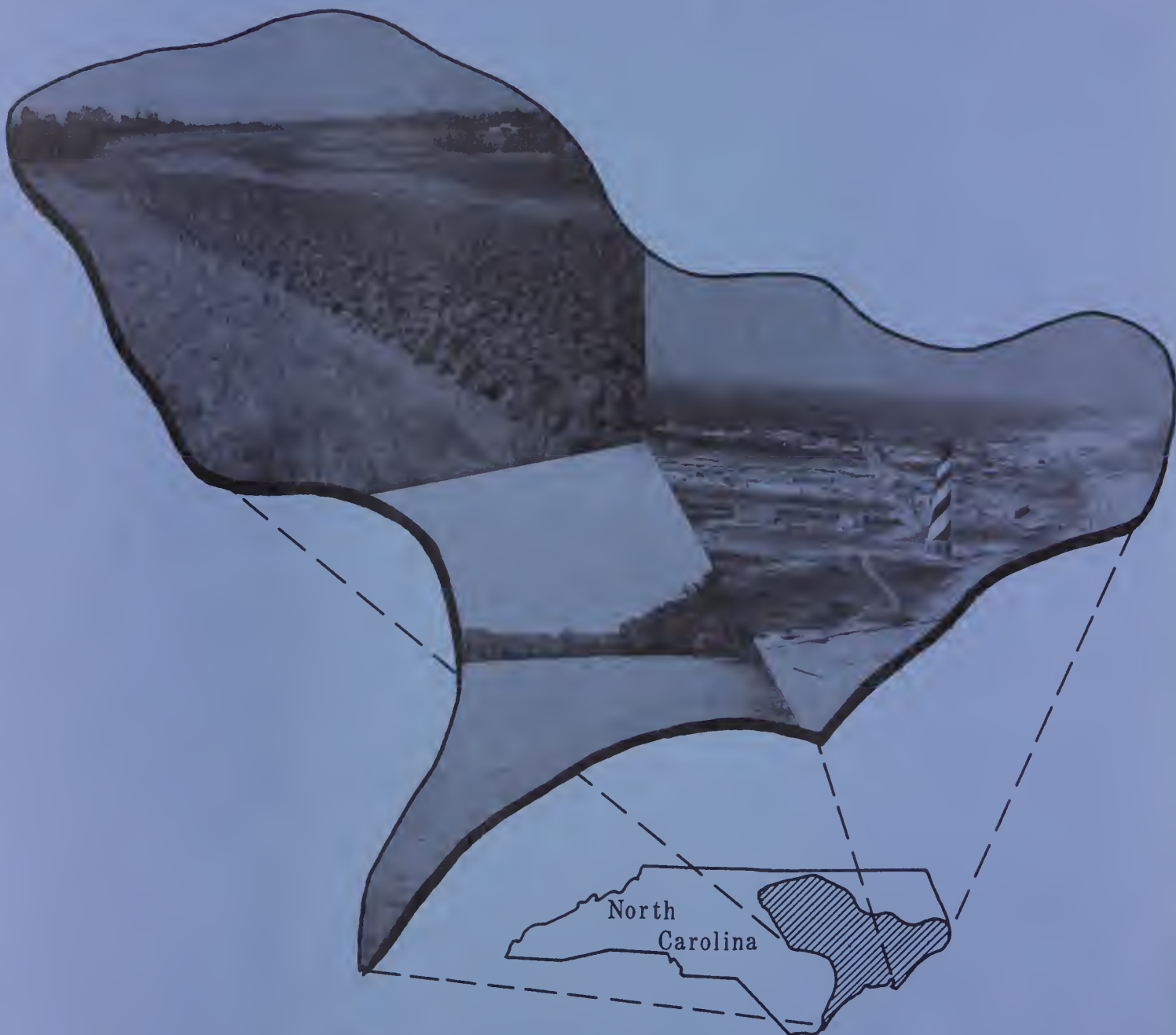
## **Historic, Archive Document**

Do not assume content reflects current scientific knowledge, policies, or practices.



Reserve  
aTC425  
.T37T37

# TAR-NEUSE RIVER BASIN MAIN REPORT



Prepared By  
UNITED STATES DEPARTMENT OF AGRICULTURE  
Soil Conservation Service  
Economics, Statistics and Cooperative Service  
Forest Service

October 1980

AD-33 Bookplate  
(1-48)

**NATIONAL**

**A  
G  
R  
I  
C  
U  
L  
T  
U  
R  
A  
L**



**LIBRARY**

TAR-NEUSE RIVER BASIN  
NORTH CAROLINA  
MAIN REPORT

T A B L E     O F     C O N T E N T S

	<u>PAGE</u>
SUMMARY .....	S-1
PREFACE .....	P-1

C H A P T E R   I

PROBLEMS AND CONCERNS

Introduction .....	I-1
Flood Prevention & Improved Drainage .....	I-1
Water Supply .....	I-3
Forest Resources .....	I-3
Recreation .....	I-4
Wetlands .....	I-4
Wildlife Habitat .....	I-4
Areas of Natural Beauty .....	I-5
Cultural Resources .....	I-5
Land & Water Quality .....	I-6
Summary of Concerns .....	I-8

C H A P T E R   II

ALTERNATIVES

Introduction .....	II-1
Future Without Action Alternative .....	II-1
Economic Development Alternative .....	II-2
Environmental Quality Alternative .....	II-5

U. S. DEPT. OF AGRICULTURE  
NATIONAL AGRICULTURAL LIBRARY

APR 27 1981

CATALOGING = PREP.

TABLE OF CONTENTS  
-Continued-

C H A P T E R   I I I

PAGE

RESOURCE DEVELOPMENT -- SUMMARY STATUS AND IMPLEMENTATION  
OPPORTUNITIES

Introduction .....	III-1
Summary Status .....	III-1
Land Resources .....	III-1
Forest Resources .....	III-3
Water Supply .....	III-4
Water Quality .....	III-5
Recreation .....	III-5
Cultural Resources .....	III-7
Areas of Natural Beauty .....	III-8
Fish and Wildlife .....	III-8
Implementation Opportunities .....	III-8
Land Treatment Opportunities .....	III-8
Watershed Development Opportunities .....	III-9
Resource Conservation & Development Area Opportunities .....	III-10
Forestry Development Opportunities .....	III-10
Opportunities for Other USDA Programs .....	III-11
Special Study Areas .....	III-14
Tar River Above Louisburg .....	III-12
Neuse River Above Falls Reservoir .....	III-12
Opportunities for Non-USDA Programs .....	III-14

T A B L E S

NUMBER

I-1	Specific Components of Economic Development Objective And Component Needs, Present and Projected Without Project Action .....	I-9
I-2	Specific Components of Environmental Quality Objective And Component Needs, Present and Projected Without Project Action .....	I-10
II-1	Summary Comparison of ED and EQ Alternatives To Meet Component Needs, 1990 .....	II-8



TABLE OF CONTENTS  
TABLES -- Continued

	<u>PAGE</u>
II-1 Summary Comparison of ED and EQ Alternatives To Meet Component Needs, 1990 -----	II-8
II-2 Summary Comparison of ED and EQ Alternatives To Meet Component Needs, 2020 -----	II-10
II-3 Conservation Land Treatment Practices for On-Going Program (Present to 2020) and the Accelerated Program Needed to Fully Treat All Crop and Pasture Acres -----	II-13
III-1 Land Use Projections -----	III-17
III-2 Status of Land Treatment Program (1976) -----	III-17
III-3 Net Annual Growth and Removals From Growing Stock By Species Group -----	III-18
III-4 Forest Land Treatment, Costs and Benefits With and Without USDA Program, 1990, 2020 -----	III-18
III-5 Status of Watershed Projects -----	III-19

M A P S

I-1 Generalized Erosion Areas	
I-2 Estuarine Shoreline Erosion	
I-3 Inland Limits of Saltwater Intrusion-----	Chapter I
II-1 CNI Watersheds -----	Chapter II
III-1 PL-566 Projects	
III-2 Active RC&D Projects -----	Chapter III

## SUMMARY

### PURPOSE AND AUTHORITY

The Tar-Neuse River Basin Study, authorized by the United States Department of Agriculture in 1971, is a cooperative Federal-State undertaking to identify associated land and water resource problems and to develop alternative plans for solving these problems. The Study was initiated at the request of the Governor of North Carolina, not only to seek solutions to land and water resource problems, but also to meet the needs identified through programs of management and development of resources that will contribute most to improving the quality of life for all people of the Basin.

Authorization for USDA participation in the Study is provided in Section 6 of the Watershed Protection and Flood Prevention Act of the 83rd Congress (Public Law 566, as amended). This legislation authorizes the Secretary of Agriculture to cooperate with other federal, state, and local agencies in their investigation of watersheds and river basins to develop coordinated programs.

### PARTICIPANTS

Principal study participants within the USDA were the Soil Conservation Service; the Economics, Statistics and Cooperatives Service; and the Forest Service. Also contributing was the North Carolina Department of Natural Resources and Community Development, Office of Water Resources. Assigned personnel functioned as an interdisciplinary planning team under the guidance of the Field Advisory Committee.

### DESCRIPTION OF THE AREA

The Tar-Neuse River Basin is located in east-central North Carolina. Covering approximately 13,895 square miles, the hydrologic area lies entirely within the state boundaries and encompasses either all or part of 29 counties. The Basin area is almost 200 miles long and ranges from 55 to 90 miles wide through most of its length. It includes 26 percent of the land area of North Carolina.

The hydrologic area is composed of the Tar and Neuse Rivers and their contributing land areas. The Tar River flows from Person County southeast to Washington where it becomes the Pamlico River. The Eno, Flat and Little Rivers form the headwaters of the Neuse River. The Tar and Neuse Rivers flow into the Pamlico Sound which flows into the Atlantic Ocean. Other tributaries of the system include the Newport, White Oak, and New Rivers which drain into Onslow Bay (see Map A-1).



## PROBLEMS AND NEEDS

Early in the Study, citizens of the Basin recognized the changes taking place and the demands being placed on resources. It was felt that changes should be anticipated, considered and directed in an orderly manner. A list of concerns was subsequently developed which established the major focus of the Study.

The problems and needs of the Basin's land and water related resources are primarily those concerned with improvement in the quality of life through development, protection, enhancement, and utilization of the resources. Needs of the Basin were identified for economic development and environmental quality objectives based on the study of concerns and inventory of problems.

## ALTERNATIVES

Three alternative plans have been developed to address the problems and satisfy those needs identified in the Study. The first alternative is a future without action plan. To comply with the US Water Resources Council's Principles and Standards for Planning Water and Related Land Resources, two other plans were formulated--one emphasizing economic development and the other emphasizing environmental quality through protection, development and enhancement of resources.

Under the future without action alternative, all resources would remain in their present condition or continue to change at the current rate.

The Economic Development (ED) alternative was formulated to optimize the role of water resource development in expanding the output of goods and services and to meet all identified needs. This is to be accomplished through 46 economically feasible PL-566 watershed projects and three Resource Conservation and Development areas.

In recognizing concerns for the environment, the Environmental Quality (EQ) alternative proposes a plan to meet its objective through conservation of land and water resources, preservation and restoration of certain natural and cultural resources, and improve land and water quality. These components will be satisfied partially through PL-566 projects and RC&D project measures. Other means of meeting needs will be through the Water Bank Act, Natural and Scenic Rivers Act, Water Pollution Control Act, National Historic Preservation Act and other federal and state programs.

## RESOURCE DEVELOPMENT -- SUMMARY STATUS AND IMPLEMENTATION OPPORTUNITIES

Implementation of any of the various parts of the plans' alternatives will be accomplished through assistance from the cooperation of federal, state and local agencies, and interested individuals and other groups. Installation will depend on local units of government and organizations to initiate requests for assistance, and their willingness to assume leadership, financial and legal responsibilities. USDA and other federal and state agencies are available to provide technical and financial assistance for implementing elements of the alternatives.



## PREFACE

Prior to this Study, the people of the Tar-Neuse Basin became aware of changes occurring and demands being placed on the land and water related resources. These concerns were expressed and the Study was initiated at the request of the Governor of North Carolina.

The Tar-Neuse River Basin Study is authorized under Section 6 of Public Law 566, as amended. Planning guidelines for the Study were based on the principles and standards developed by the Water Resources Council and published in the Federal Register on September 10, 1973.

The Soil Conservation Service had overall responsibility for the Study. Basically, this responsibility includes the gathering, analysis, review, and preparation of data concerning water related problems and the coordination of other agency input into a final report.

The Forest Service had the responsibility of providing data, inventories, analyses, recommendations, and projections pertaining to the interrelationship of forest resources to the total environment with respect to current and future demands.

The Economics, Statistics and Cooperatives Service, formerly the Economic Research Service, had the responsibility of compiling and analyzing statistics relating to the economic base of the study area. In addition, the ESCS has contributed assessments of economic impacts of plans and alternatives as well as appraisals of projected requirements for food, fiber, land, and water resources.

The North Carolina Department of Natural Resources and Community Development contributed data on water resources, primarily water supply data, through the Office of Water Resources.

Information developed from the Study has resulted in the preparation of twelve detailed special sub-reports. These are:

1. Agricultural and Forestry Economic Characteristics (April 1975)
2. Air Resources and Air Quality (July 1977)
3. Erosion and Sedimentation (May 1978)
4. Forest Resource Report (August 1980)
5. Historic and Architectural Resources (February 1977)
6. Inventory of Land and Water Resources and Projected Needs ( )
7. Potential Structure Sites (June 1975)

8. Population, Employment and Income Projections  
(June 1975)
9. Shoreline Erosion Inventory (May 1980)
10. Soil Productivity Groups (April 1975)
11. Special Studies
  - (a) Hyde County Flood Control and Drainage (June 1975)
  - (b) Lake Phelps Study (June 1975)
12. Wildlife Resources (November 1974)

Copies of the above reports can be reviewed at the Soil Conservation Service, State Office, Raleigh, North Carolina 27611.



## CHAPTER I

### PROBLEMS AND CONCERNS

#### Introduction

The Tar-Neuse River Basin Study was authorized by USDA in 1971. Subsequent to authorization of the Study, a Plan of Work and Work Outline were developed (1973) to determine study procedures, identify problems and concerns of the public, and establish objectives of the Study. The Plan of Work was revised in 1976 to incorporate into the planning process procedures set forth in the Water Resources Council's Principles and Standards for Planning Water and Related Land Resources.

Problems and needs of the Tar-Neuse River Basin are related to the improvement in the quality of life through development, protection, enhancement, and utilization of the water and land-related resources of the Study Area. Changes are taking place within the Basin because of the demands that are placed upon the resources. The people of the State of North Carolina are concerned that the changes being made should be anticipated, considered, and brought about in an orderly manner. Concerns of the people within the Basin have been expressed by members of various organizations, interested groups and individuals. Detailed descriptions of the water related problems and concerns (needs) are presented in this chapter and are summarized in Tables I-1 and I-2 with net needs shown for present and target years 1990 and 2020.

All tables are presented at the end of each chapter.

#### FLOOD PREVENTION AND IMPROVED DRAINAGE

Flooding and improper drainage are problems throughout the Basin, occurring in small upstream watersheds as well as along the major streams. There are 845,000 acres of land subject to flooding, representing approximately 12 percent of the land area in the Basin. Of this amount, 440,000 are along main streams and 405,000 acres are in the upstream watersheds.

Flood damages occur on 769,800 acres of agricultural crops and pasture (Table I-1), 29,500 acres of residential and commercial property and 47,500 acres of land in other uses. Fixed improvements and roads and bridges also sustain flood damages. In addition, inseparable flooding and impaired drainage<sup>1/</sup> problems exist on 1,818,000 acres including 910,700 acres of cropland, 168,900 acres of pastureland and 239,000 acres of commercial forest. Losses caused by flooding and inadequate drainage are reflected in decreased yields, inefficiencies in planting and harvesting are occasionally loss of an entire crop.

<sup>1/</sup> All terms underlined (exclusive of titles) throughout this report are defined in a glossary, found in the Appendix.

Cropland flooded from inseparable flooding and drainage where direct rainfall cannot be removed from the field.



Urban flooding from out of banks flow washing buildings away from their original location.



Residential flooding from out of banks flow causing damage to buildings and their contents.



## WATER SUPPLY PROBLEMS

Water supply status differs in the two physiographic areas of the Basin. The Coastal Plain contains high yield ground water aquifers capable of meeting most projected needs through the year 2020. Present water demands for municipal and industrial use in the Piedmont are adequately met primarily from surface supplies. These supplies, however, are not expected to satisfy all projected demands and are a major concern.

In many instances, the reservoir sites that could provide a portion of the projected supplies will not be developed as their use will be pre-empted for highways, utilities and utility rights-of-way, and residential developments.

## FOREST RESOURCE PROBLEMS

According to projections made of future supply/demand conditions, the volume of industrial wood demanded by the year 2020 will exceed available net annual timber growth supplies by an estimated 37 percent. Three major factors will help create this situation: (1) total forest acreage available for timber production is being converted to other uses at an average rate of 19,000 acres per year; (2) mortality due to natural suppression, insects and diseases, weather and wildfire reduces gross annual growth volumes by an estimated 9 percent each year; and (3) recent levels of timber management activity, if continued, will inadequately meet future salvage, harvest, timber stand improvement, stand conversion and regeneration needs generated by the impacts of forest land losses, mortality and increased wood demands.

In addition to possible future problems in meeting wood production demands, there exists a current problem which is of major concern: improperly conducted logging and site preparation activities are causing annual accelerated soil erosion losses totalling an estimated 760,000 tons. This volume represents an increase of 85 percent over-and-above that normally expected to occur on Basin forest lands. The related volume of sediment estimated to reach natural waterways amounts to roughly 163 tons per year. Erosion volumes due to improper management activity are expected to increase 13 percent and 12 percent by the years 1990 and 2020, respectively.



Many Basin forest lands are poorly stocked and in need of intensive timber management.

## RECREATION - LACK OF FACILITIES

The North Carolina Water Resources Framework Study (1977) discloses that visitors spend more than \$1 billion each year in the state, much of which is for enjoyment of North Carolina's outdoor recreation resources. An abundant outdoor recreation base exists in the Tar-Neuse Basin; however, facilities to provide maximum utilization are unavailable for current demands and are the major concern. The North Carolina Statewide Comprehensive Outdoor Recreation Plan (SCORP) data indicate there is need for over 300,000 additional acres of land and water for recreation.



Shortage of adequate water related recreational facilities is a problem identified in the Basin.

## WETLANDS - CONCERN FOR DESTRUCTION

Wetlands in the Basin provide valuable habitat for both upland and bottomland species. Important waterfowl wintering grounds include Pamlico, Core and Bogue Sounds with adjacent bays and marshes; Lake Mattamuskeet, Phelps Lake and Great Lake; and river bottomlands and swamp areas.

Drainage, flood control, farm expansion and urban development have contributed to losses of wetlands. It is estimated that as much as seven percent of North Carolina's coastal wetlands were destroyed between 1954 and 1968. Future wetland destruction is the major concern.

## WILDLIFE HABITAT - ALTERATION OF HABITAT

There are two major natural regions in the Tar-Neuse Study Area - the Piedmont, a typically hilly, upland region and the Coastal Plain, a much flatter terrain. Encompassed within these regions are many varied wildlife habitat types; including, upland hardwoods, bottomland hardwoods, pine forests, mixed pine and hardwood forests, marshes, swamps, etc.



The greatest concern to wildlife habitat in both regions is the alteration of the habitat as a result of land-use changes and more intensive land management practices. Changes from primeval forest to urban and agricultural uses have caused changes in the existing wildlife populations. More intensive land management with the existence of larger farm systems (and resultant loss of hedgerows, wood lots, etc) and the increased trend to monocultural food and fiber production has placed additional pressures on those species requiring a more natural forest situation.

Highly specialized species (black bear, red-cockaded woodpecker et. al.,) are now more vulnerable to habitat change than those species such as the whitetailed deer, raccoon, and mourning dove. Thus, the highly specialized species have become more restricted in the Tar-Neuse River Basin while the more adaptable species have increased as the habitat changes have occurred.

#### AREAS OF NATURAL BEAUTY - CONCERN FOR PROTECTION

Open space and environmental corridors are areas within or adjacent to urban centers that may be used for human enjoyment or recreation. Included are wetlands, estuaries, water-land interfaces and urban spaces. As urban centers expand, many of those areas are potentially eliminated by roads, utilities, commercial facilities and residences. The primary concern is that additional areas should be protected through restricted use so that the quality of existing areas will not be diminished by overuse.

Recreational demands of an increasing population are intensifying, and the opportunity for preserving the natural and scenic beauty of many streams has passed. The need for sustaining these values on remaining streams is recognized by state and federal governments through established criteria for classification and protection. Included are those rivers or sections of rivers that are free of impoundments, with watersheds still mostly primitive and shorelines largely underdeveloped.

#### CULTURAL RESOURCES (Archaeological, Architectural, and Historical) - AWARENESS

Preservation of historic properties is an uphill battle, and many of the Basin's finest architectural and archaeological resources have been lost. In recent years there has been a public reaction to the destruction of these properties resulting in the formation of preservation groups and new legislation for preservation, such as income tax incentives for rehabilitating historic commercial structures and effective zoning for historic areas. The most important aid to safekeeping is the increased public awareness of the nature of our historic and prehistoric environment and the need to preserve it.

More than 2,000 eighteenth, nineteenth, and early twentieth century structures of historic significance are widely scattered throughout the Tar-Neuse region. Of these, over 200 structures and historic districts are listed in the National Register of Historic Places. The major concern of the people is that while the Register provides a degree of protection for a historic property or archaeological site, it does not guarantee its preservation. Local zoning to protect historic districts and the concern and efforts of a community, whether urban or rural, are important to the revitalization, protection and continued use of a community's heritage.



Valuable historical properties are being lost through lack of care.

#### LAND AND WATER QUALITY - DETERIORATION

Upland erosion consists primarily of sheet and rill erosion but includes other types such as gully erosion (see Map I-1). Maps are presented at end of each chapter. Erosion is a natural process that cannot be completely halted and is more profoundly affected by man's activities than most other natural processes. Sound land use and conservation can keep erosion within acceptable limits, so that in spite of natural erosion the soil remains fertile and productive through geological and chemical processes. Maintaining this productive capability of the soil is of primary concern to the people of the Basin.

Parts of the Coastal Plain area of the Basin are subject to wind erosion. The region typically has sandy loam soils, large open tracts of cultivated land and negligible cover or crop residue during the spring.

# SHORE EROSION



Shore erosion on this farm has averaged 10 feet per year since 1938.



Wave action is eroding this field at the rate of 12 feet per year.



Estuarine shoreline erosion within the estuaries of the Tar-Neuse River Basin has been proceeding for several thousand years. Over the last 30 years erosion rates of up to 20 feet per year have been reported, and losses of 2 to 3 feet per year are typical. Shoreline buildup is rare and, for the most part, temporary (see Map I-2).

For the past several years, there has been increasing awareness of the shoreline erosion problem. Each year soil and water conservation districts receive increasing numbers of requests for technical assistance in reducing shoreline erosion. Extensive shoreline property development during the two decades has greatly increased the value of waterfront property and has heightened concern about erosion threats.

Sediment is that portion of eroded soil that reaches water courses, damages other lands and channels, and eventually fills channels, lakes and estuaries. In addition, sedimentation causes a reduction in flood plain productivity and a lowering of water quality. An estimated 15.3 million tons of soil are eroding from the land in the Tar-Neuse River Basin annually with about 26 percent, or 4.0 million tons per year, reaching the water courses in the River Basin.

Withdrawal of fresh water from wells results in a lowering of water levels in the surrounding area. In many areas of the coastal region with very large withdrawals, salt water in the sediments has been flushed from the ground water system through natural recharge. However, it is suspected that some drawdowns caused by pumping have reversed the gradient by which flushing is accomplished, resulting in local movement of the salt water front toward the source of withdrawal (see Map I-3).

Water quality problems due to eutrophication were not addressed in this study.

#### SUMMARY OF MAJOR CONCERNS

The primary problems and concerns of the people of the Basin in order of importance are: (1) flood prevention and improved drainage, and (2) erosion and sedimentation.



TABLE 1-1 -- SPECIFIC COMPONENTS OF ECONOMIC DEVELOPMENT OBJECTIVE AND COMPONENT NEEDS,  
PRESENT AND PROJECTED WITHOUT PROJECT ACTION -- TAR-NEUSE RIVER BASIN,  
NORTH CAROLINA

Specific Components	Component Needs	Units	N E E D S		
			Present	1990	2020
1. Increased and/or more efficient output of food and fiber.	Increase acreage of flood-free agricultural land	1000ac	770	645	763
	Improve drainage on crop and pastureland	1000ac	1,080	981	1,146
	Protect and maintain soil productivity:				
	Treatment	1000ac	1,275	1,300	1,350
	Protection	1000ac	1,075	800	850
	Develop and improve protection and management of forest resources:				
	Treatment	1000ac	2,147	2,147	2,147
	Protection	1000ac	474	474	474
	Improve shoreline protection	Miles	650	650	650
2. Increased and/or more efficient production of surface water supplies and ground water storage for M&I and agricultural uses.	Increase water supply and site preservation	MGD	1	30	770
3. Increased output of water-based and non water-based recreational opportunities.	Provide land and water for recreation	1000ac	311	316	326

TABLE 1-2 -- SPECIFIC COMPONENTS OF ENVIRONMENTAL QUALITY AND COMPONENT NEEDS,  
PRESENT AND PROJECTED WITHOUT PROJECT ACTION-- TAR-NEUSE RIVER BASIN,  
NORTH CAROLINA

Specific Components	Component Needs	Units	N E E D S		
			Present	1990	2020
1. Improve quality of water, land and air.	Provide seasonal water storage for water quality and habitat improvement and reduce saline intrusion in aquifers.	Acres <sup>1/</sup>	-	-	-
	Reduce Erosion	1,000,000tn/yr	15	17	19
	Reduce Wind Erosion	1,000ac	<sup>1/</sup> -	100	206
	Reduce sedimentation in streams, lakes, ponds, etc.	Mill. tn/yr	4	4	5
2. Preserve and restore areas of natural beauty and places of archaeological, historic and scenic value	Preserve open space and environmental corridors	Miles/No.	N/A	475	475
	Preserve wild and scenic sections of rivers	Segments	23	23	23
	Protect rare and endangered species	No./Species	93	93	93
	Conserve prime water-fowl habitat	1,000ac	250	250	250
	Enhance existing fishery and waterfowl habitat and develop additional habitat	1,000ac	575	563	551
	Improve upland wildlife habitat	1,000ac	5,668	5,662	5,656
	Develop awareness of historic resources of the study area	Sites	2,184	2,184	2,184

<sup>1/</sup> Needs not quantified during inventory.









ESTUARINE SHORELINE EROSION 1/  
TAR-NEUSE RIVER BASIN  
NORTH CAROLINA

County 2/	Length of Shoreline Studied [MI]	Length of Shoreline Eroding [MI]	Total Area Lost [Ac]	Total Sediment Produced [Ton]	Average Sediment Produced [Ton/MI/Yr]	Average Height of Bank [ft]	Average Width of Area Flooded Area [ft]	Average Erosion Rate [ft/Yr]	Length of Shoreline Accretion [MI]	Period of Time Covered by Study [Yr]
1. Dare	41.0	40.0	278.6	647,920	730	1.5	44.0	2.0	0	22
2. Hyde	23.0	735.0	2216.0	3,126,057	532	0.8	75.0	3.0	0	25
3. Beaufort	148.4	126.1	963.1	6,430,365	1,588	3.4	53.8	1.7	0	32
4. Pamlico	54.74	34.23	713.16	8,164,563	4,703	5.6	112.0	3.3	0	33
5. Craven	47.41	46.56	684.41	11,405,468	10,340	11.5	171.0	3.8	0	17
6. Carteret	178.89	146.61	875.31	7,093,700	7,649	4.1	50.7	2.79	10.13	18
7. Onslow	64.1	26.0	55.0	1,000,316	2,114	9.1	17.5	1.1	5.7	15/21 3/

1/ Source: "Shoreline Erosion Inventory, North Carolina", U. S. Department of Agriculture, Soil Conservation Service, Raleigh, North Carolina, October 1915.  
2/ The extent of maximum erosion along the inland shorelines of Pender and New Hanover Counties was judged to be minimal and no detailed inventory was undertaken.  
3/ Weighted into used for two periods of study: 1949 to 1970 and 1949 to 1964

I-2  
ESTUARINE  
SHORELINE EROSION

TAR-NEUSE RIVER BASIN  
NORTH CAROLINA

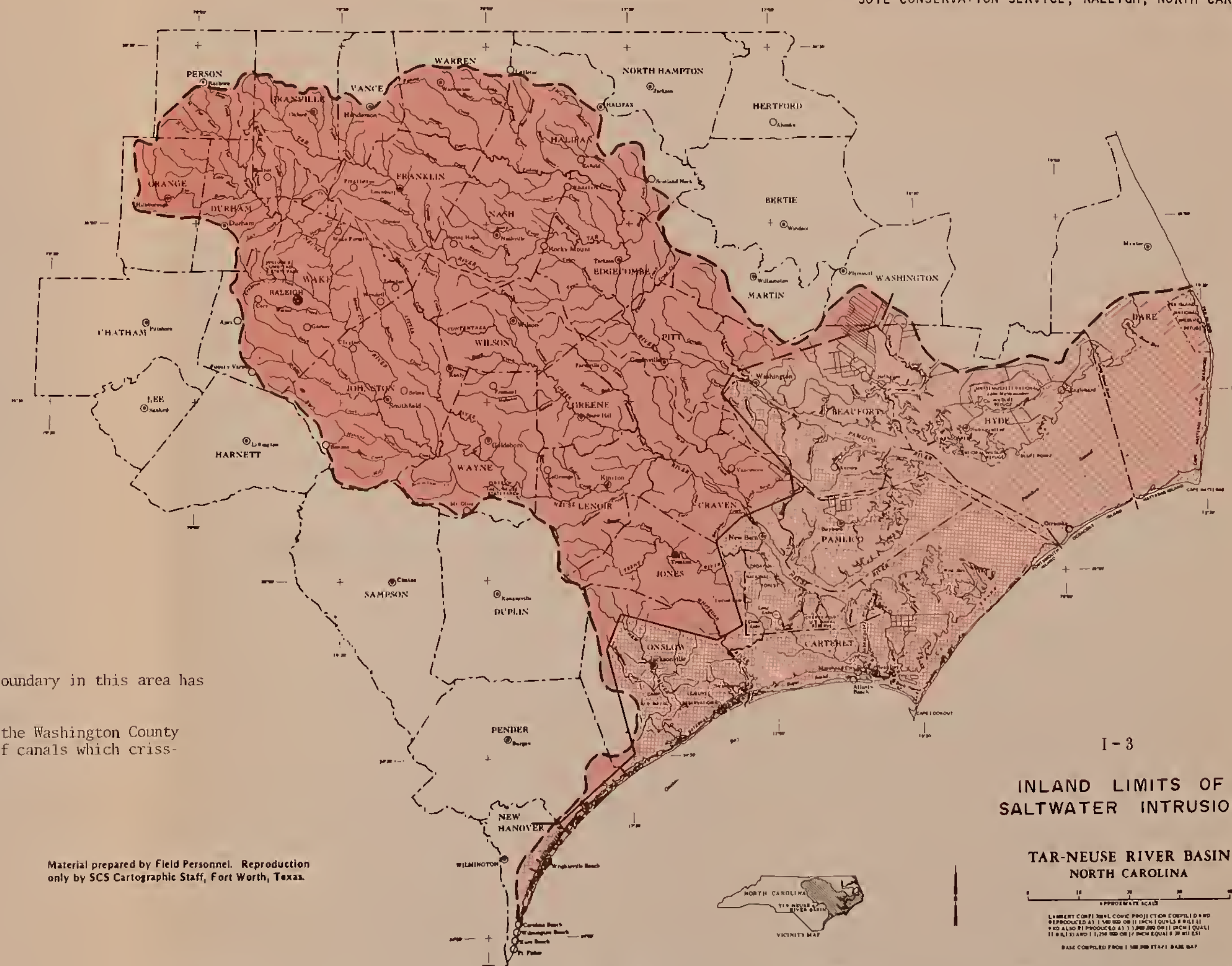
0 10 20 30 40  
APPROXIMATE SCALE

Lambert Conformal Conic Projection.  
Base Compiled for 1:500,000 State Base Map.

Source: Data Compiled by  
River Basin Staff.









## CHAPTER II

### ALTERNATIVES

#### Introduction

The alternatives presented in this chapter result from the problems and concerns as identified in Chapter I and represent the combined efforts of state, federal, and local agencies and individuals. Each alternative specifies component objectives and plan elements that satisfy the concerns of one of these participants.

Three alternatives are presented--future without action, economic development (ED), and environmental quality (EQ). Under the future without action, all resources would remain in their present condition or continue to change as currently changing. The ED objective optimizes the role of water resource development in expanding national output of goods and services while the EQ emphasizes environmental quality.

An analysis of component needs indicates there is some overlap, or areas where these needs are practically the same in both the ED and EQ objectives. For example, solutions primarily concerned with wetlands, and land and water quality are essentially the same in all alternatives. However, there are conflicts in meeting some needs: flood prevention, improved drainage elements, land treatment where wetness is a hazard, and water supply in the ED, can conflict with preservation of areas of natural beauty, cultural resources and ecological communities in the EQ.

"Summary Comparison of ED and EQ Alternatives to Meet Component Needs" for 1990 and 2020 is presented in Tables II-1 and II-2.

#### FUTURE WITHOUT ACTION ALTERNATIVE

The future without action plan conditions described the Basin's future based on the continuation of present programs but at uncertain rates (see Tables I-1 and I-2). Some programs change from year to year while others remain constant or are cancelled. Many conditions such as flooding and impaired drainage would worsen due to expected changes in land use. The reduction of erosion would be only slightly affected by existing programs and water quality would likely continue to decline.

Demands for recreation facilities will continue to increase and will place an increasing demand on the need for available surface water. Available fish and wildlife habitat will continue to decline as the stress on water and related land resources increases. Existing programs would have little effect on increasingly adverse conditions consisting of the misuse and mismanagement of resources.



## ECONOMIC DEVELOPMENT ALTERNATIVE

The objectives of the ED alternative is to promote national economic development by increasing the value of the nation's output of goods and services and improving economic efficiency. Elements included in the ED alternative were selected on the basis of their ability to satisfy component needs emphasizing economic development.

An important phase of watershed projects is the opportunity for installation of land treatment measures. These may be installed prior to, concurrently with, or following the completion of structural measures. The amount and costs of all land treatment needed throughout the Basin for the ED alternative are displayed in Table II-3 for 1990 and 2020.

Land treatment on 1.3 million acres installed (1990) in the ED alternative would be aimed primarily at maximizing production of food and fiber. In addition, 0.8 million acres treated adequately would provide protection against erosion. For 2020, treatment for maximum production would be needed on 90,000 acres, and for erosion protection on 50,000 acres.



Land treatment measures, strip cropping and grassed waterways reduce soil erosion.

To meet the needs for flood reduction and improved drainage in the Basin, 91 watersheds were studied and 46 determined to be economically feasible (see Map II-1 CNI Watersheds). Of these, 17 are in the Tar River Basin, 26 are in the Neuse River Basin, and three are in the White Oak-New River drainage area. Five watersheds from each of the Tar and Neuse Basins are in the Piedmont. Two of the Neuse River watersheds are in the upper Coastal Plain. The remaining 34 watersheds are in the lower Coastal Plain...19 in the Neuse Basin, 12 in the Tar Basin and three in the White Oak-New River Drainage area.

These 46 watersheds have a total drainage area of 3.15 million acres and will provide 40 reservoirs that allow flood reduction on 32,000 acres of cropland by 2020. Benefits from flood reduction and drainage will result on 1.3 million acres of agricultural land, of which 350,408 acres are crop and pastureland.

Of the 40 reservoirs, six municipal and industrial sites would provide 4.33 mgd of municipal water supply to the Piedmont area. Additional supplies are available from an existing Corps of Engineers Reservoir outside the Basin (Kerr Lake) and a soon to be completed Corps of Engineers Reservoir on the Neuse (Falls Reservoir).

Forest resources treatment refers to any one or more of the following activities aimed at increasing wood production on forest lands: (1) harvest (clear-cutting) followed by site preparation and tree planting, (2) thinning (intermediate cutting) and other stand improvement techniques, (3) artificial regeneration, and (4) stand conversion. Acreages listed in Tables II-1 and II-2 represent various combinations of these treatments.

Objectives of the ED alternative are concerned with maximizing total potential wood production outputs on over 2.1 million acres of forest land. Under the EQ alternative, emphasis is placed on the management of bottomland forests for wildlife habitat, soil and water protection and other non-timber values. Treatment for timber production is concentrated on various upland sites identified as being in need of intensive management. Stands managed for such purposes additionally provide various soil, water, and wildlife benefits.

Protection of forest land in Table II-1 is related only to forested areas on which erosion is a problem. Both the ED and EQ alternatives address, though neither entirely solve, the erosion problem. Table II-2 shows that even by the year 2020 there is a remaining unprotected segment. The \$56 per acre cost of protection depicts a costly procedure which must be continued for long periods of time.

Recreation developments to meet the 326 thousand acres identified as needed by 2020 (Table II-2) were planned as part of the PL-566 watersheds found to be feasible elements of the ED alternative. These developments in the Piedmont portion of the study area consist of land adjacent to the reservoirs developed to provide swimming, fishing, hiking, camping and picnic facilities and other compatible facilities. In the Coastal Plain the recreation facilities consist of land developed adjacent to the stream to allow boat access, bank fishing, picnic facilities, camping facilities and other compatible recreation facilities. A total of three thousand areas is planned in the ED alternative (Table II-2) of this, one thousand acres are proposed as part of the early action ED alternative (Table II-1).

There was a need identified to preserve 250 thousand acres of prime waterfowl habitat (Tables II-1 and II-2) Under the Economic Development alternative no plans were set forth to preserve any of this habitat.

The study has identified a need for 475 miles of environmental corridors. The Economic Development Alternative has no provisions to establish any of the needed corridors.

Twenty-three segments of basin streams (see Tables II-1 and II-2, and Map A-13) have been identified as possible natural and scenic streams. Of the 23 identified several were eliminated after rating them by the established rating system. However, two were found to meet the requirements of scenic streams and are recommended in the Economic Development Alternative. One, the Eno in Eno State Park was recommended as a water trail while the Town Creek on the Tar River was recommended as having the necessary qualities to be a natural and scenic stream.

Economic development in the Tar-Neuse River Basin can be augmented further by the recognition and appropriate utilization of the rich historic resources of the region. The Historical and Architectural Resources of the Tar-Neuse River Basin, published in 1977, recorded 2,184 significant properties in the 29 counties. Since then, more intensive inventories in several counties and municipalities have identified hundreds of additional sites and structures of importance.

The rehabilitation and re-use of old buildings, when compared with new construction, has been demonstrated generally to be less expensive and to require less energy. The Tax Reform Act of 1976 allows for the rapid amortization or accelerated depreciation of expenses incurred in the rehabilitation of income-producing property listed in the National Register, and the Revenue Act of 1978 permits a 10 percent tax credit for the rehabilitation of commercial and industrial buildings twenty years old and older.

Erosion control plans described in Table II-1 also constitute the alternatives for improving water quality. This aspect of erosion reduction is important to economic development by preventing water supply reservoirs from filling with sediment. Since sediment has been identified as a transport mechanism for nutrients and other chemicals, these measures may also have an impact on treatment levels needed for maintaining safe drinking water. Therefore, these measures contribute to several economic development objectives in addition to protecting the soil resource base.

On forest land, protection is slanted to the more serious erosion causing activities such as log roads, skid trails, and site preparation activities (K-G blade, roller-chooper, etc.) These types of disturbances all erode at greater than 2 tons per acre per year. The problem is perpetual because new acres are disturbed each year. Tables II-1 and II-2 show that treatment



is the same for the EQ and ED alternatives regardless of time frame. This is true because the need for erosion control is important in both alternatives. The requirements of PL 92-500 have made it imperative that erosion be recognized in all land management activities.

No plans were set forth in the ED alternative for shoreline erosion protection.

#### ENVIRONMENTAL QUALITY ALTERNATIVE

The environmental quality objective is to reflect concern for the environment and its enhancement as a source of enjoyment for the present and for future generations. Specific components of the objective include (1) conservation of land and water resources, (2) preservation and restoration of certain natural and cultural resources, and (3) improvement of land and water quality. This alternative also provides for some overlap of economic development components where these needs do not conflict with environmental quality component needs.

Land treatment measures installed in EQ are essentially the same as for the ED alternative except emphasis will be placed on protective measures to reduce erosion. These treatment elements would provide damage reduction on 750,000 acres where erosion is a problem.

Flood damage reduction elements through PL-566 include 28 floodwater retarding structures in the seven watersheds. These are the same structures as in the economic development alternative and are included in the EQ because of their effectiveness in control of sediment damages. Benefits will occur on 47,482 acres of agricultural land. The EQ alternative does not provide for improved drainage benefit through structural measures.

Forest resources component needs are essentially the same as those in the ED alternative. A description of these needs and treatment activities is presented in that section of this chapter.

In the Environmental Quality Alternative only those recreation facilities associated with the proposed sediment control structures in the upper portion of the Basin are included. This will provide only one thousand acres of recreation (Tables II-1 and II-2).

Unlike the Economic Development Alternative, in the Environmental Quality Alternative there is a proposal to preserve 200 thousand acres of prime waterfowl habitat in the Basin (Table II-2) using the Water Bank Act, as amended, to reach this goal. The 200 thousand acres are scattered throughout 15 counties in the Basin. Initially, in the early action plan, it is proposed to establish the Water Bank program in three counties - Craven, Hyde and Pitt with 60 thousand acres (Table II-1) of wooded swamp being preserved.

No environmental corridors are planned in the EQ alternative.

Planned scenic streams in the EQ are the same as those proposed in the ED alternative (Tables II-1 and II-2).



Section of Eno River proposed as water trail in the Eno River State Park.

The environmental quality of an area includes its man-made environment and its cultural resources. Cultural resources are defined as including properties of archaeological, architectural, or historic significance. Archaeological sites are significant for the information they provide about the prehistory (10,000 B.C. to European contact) and history of human occupation and settlement in North Carolina.

The history of North Carolina is contained not only below the ground but above in the historic structures and buildings. Fundamental to any preservation planning effort is the identification and evaluation of properties considered significant enough to preserve. The protection of historic buildings requires continued use and maintenance. Section 6 of the National Historic Preservation Act of 1966 provides a degree of protection to National Register properties.

Of the major investments proposed in this report, ones that most clearly benefit the environment are those providing erosion control. Sediment and associated chemicals affect streams and impoundments as well as impacting aquatic life. Since there are no negative environmental impacts from these land treatment practices, they have an important role in both ED and EQ components of this report.

SUMMARY COMPARISON OF ED AND EQ ALTERNATIVES TO MEET COMPONENT NEEDS, 1990 -- TAR-NEUSE RIVER BASIN, NORTH CAROLINA

TABLE 11-1

C O M P O N E N T N E E D S :									
Description	UNIT : Cost	: Needed : Amount	: ED		: EQ		: Remaining : Need	: Amount : Planned	: Remaining : Need
			: Amount	: Planned	: Amount	: Planned			
1. Agricultural Resource (crop & pasture)									
(a) Land treatment to maximize food and/or fiber production	1,000ac \$1,000	1,300 210,000	1,300 210,000	1,300 210,000	90 <sup>3/</sup> 15,500	800 95,000	50 <sup>3/</sup> 4,000	50 <sup>3/</sup> 4,000	
(b) Land treatment for protection against erosion	1,000ac \$1,000	800 95,000	800 95,000	800 95,000	50 <sup>3/</sup> 4,000	800 95,000	50 <sup>3/</sup> 4,000		
(c) Flood prevention only	1,000ac \$1,000	645 40,075	645 40,075	13 814	632 39,261	13 814	632 39,261		
(d) Inseparable flood prevention and improved drainage	1,000ac \$1,000	981 18,629	981 18,629	36 682	945 17,947	0 0	981 18,629		
2. Water Supply and Storage									
(a) Public Supply	mgd	30	30	0	30	0	30		
3. Forest Resources									
(a) Treatment	1,000ac \$1,000	2,147 123,674	2,147 123,674	537 30,927	1,610 92,747	275 15,754	1,872 107,873		
Upland Sites	1,000ac \$1,000	1,726 102,637	1,726 102,637	431 25,630	1,295 77,007	271 15,662	1,455 86,975		
Bottomland Sites	1,000ac \$1,000	421 21,037	421 21,037	106 5,297	315 15,740	4 92	417 20,945		
(b) Protection	1,000ac \$1,000	474 26,768	474 26,768	123 6,946	351 19,822	123 6,946	351 19,822		



TABLE 11-1

(Continued)

C O M P O N E N T   N E E D S :									
Description	UNIT <sup>1/</sup> : Cost	: Needed		: ED		: Remaining		: EQ	
		Amount	: Amount	Amount	: Planned	Need	: Need	Amount	: Planned
4. Recreation	Acres	316		1		315		1	
5. Prime Waterfowl Habitat	1,000ac	250		0		250		60	
6. Natural and Scenic Resources									
(a) Environmental Corridors	Miles	475		0		475		0	
(b) Scenic Streams	No.	23		2		21		2	
7. Cultural Resources									
(c) Historical	Sites	2,184		5/		5/		5/	
8. Land and Water Quality									
(a) Erosion reduction on:									
Agricultural Land	1,000ac	800		800		50 <sup>3/</sup>		800	
Forest Land <sup>6/</sup>	1,000ac	630		620		0 <sup>3/</sup>		630	
Other Land	1,000ac	75		75		90 <sup>3/</sup>		75	
Shoreline Erosion	Miles	635		0		635		0	
(b) Sediment reduction in streams, lakes & ponds	1,000,000 tons/yr	4		3		1		3	

1/ Represents estimated installation costs.

2/ Erosion control (b) is a component requirement in fulfilling full land treatment (a).

3/ Needs that will develop 1990-2020 due to land use changes, farm system changes, et.al.

4/ Source: Forest Resource Report, Tar-Neuse, August, 1980.

5/ No plans are included in this study to preserve any sites; further detailed inventories in the Basin will identify more sites than shown in this report.

6/ A self-perpetuating situation brought on by logging (skid trails, spur roads) and site preparation.

## SUMMARY COMPARISON OF ED AND EQ ALTERNATIVES TO MEET COMPONENT NEEDS, 2020 -- TAR-NEUSE RIVER BASIN, NORTH CAROLINA

TABLE 11-2

C O M P O N E N T   N E E D S :									
Description	UNIT 1/ Cost	ED		EQ		Remaining		Amount	
		Needed Amount	Planned	Amount Planned	Planned	Need	Need	Planned	Remaining Need
1. Agricultural Resource (crop and pasture)									
(a) Land treatment to maximize food and/or fiber production.	1,000ac \$1,000	90 15,500	90 15,500	0 0	0 0	0 0	0 0	50 4,000	40 11,500
(b) Land treatment for protection against erosion	1,000ac \$1,000	50 4,000	50 4,000	0 0	0 0	0 0	0 0	50 4,000	0 0
(c) Flood prevention only	1,000ac \$1,000	763 47,411	32 1,982	731 45,429	13 814	750 46,597			
(d) Inseparable flood prevention and improved drainage	1,000ac \$1,000	1,146 21,772	350 6,650	796 15,122	0 0	1,146 21,772			
2. Water Supply and Storage									
(a) Public Supply	mgd	770	4	766	0	770			
3. Forest Resources									
(a) Treatment <sup>3/</sup>	1,000ac \$1,000	2,147 123,674	2,147 123,674	0 0	0 0	0 0	0 0	1,100 63,052	1,047 60,622
Upland Sites	1,000ac \$1,000	1,726 102,637	1,726 102,637	0 0	0 0	0 0	0 0	1,085 62,708	641 39,929
Bottomland Sites	1,000ac \$1,000	421 21,037	421 21,037	0 0	0 0	0 0	0 0	15 344	406 20,693
(b) Protection	1,000ac \$1,000	474 26,768	369 20,838	105 5,930	105 5,930	105 5,930	105 5,930	369 20,838	105 5,930

SUMMARY COMPARISON OF ED AND EQ ALTERNATIVES TO MEET COMPONENT NEEDS, 2020 -- TAR-NEUSE RIVER BASIN, NORTH CAROLINA

TABLE 11-2

(Continued)

C O M P O N E N T N E E D S :									
Description	UNIT <sup>1/</sup> Cost	Needed		ED		EQ		Amount Planned	Remaining Need
		Amount	Amount	Amount	Planned	Amount	Planned		
4. Recreation	1,000ac	326	3	323	1				325
5. Prime Waterfowl Habitat	1,000ac	250	0	250	200				50
6. Natural and Scenic Resources									
(a) Environmental corridors	Miles	475	0	475	0				475
(b) Scenic streams	No.	23	2	21	2				21
7. Cultural Resources									
(a) Historical	Sites	2,184	4/	4/	4/				4/
8. Land and Water Quality									
(a) Erosion reduction on:									
Agricultural Land	1,000ac	50	50	0	50				0
Forest Land <sup>5/</sup>	1,000ac	1,260	1,260	0	1,260				0
Other Land	1,000ac	90	90	0	90				0
Shoreline Erosion	Miles	635	0	635	0				635
(b) Sediment reduction in streams, lakes & ponds	1,000,000 tons/yr	4.0	3	1	3				1

1/ Represents estimated installation cost.

2/ Erosion control (b) is a component requirement in fulfilling full land treatment (a).

3/ Source: Forest Resource Report, Tar-Neuse, August, 1980.

4/ No plans in this study to preserve any sites, further detailed inventories in the Basin will identify more sites than shown in this report.

5/ A self-perpetuating situation brought on by logging (skid trails, spur roads) and site preparation.

TABLE 11-3

TAR-NEUSE RIVER BASIN CONSERVATION LAND TREATMENT PRACTICES FOR ON-GOING PROGRAM  
(PRESENT TO 2020) AND THE REMAINING PROGRAM NEEDED TO FULLY TREAT ALL CROP AND  
PASTURE ACRES AND FOREST ACRES

Conservation Land Treatment Measures to be Applied	Units	P R E S E N T T O 1 9 9 0			1 9 9 0 t o 2 0 2 0		
		On-Going Program (1,000)	Remaining Need (1,000)	Remaining Cost <sup>3/</sup> (1,000)	On-Going Program (1,000)	Remaining Need <sup>2/</sup> (1,000)	Remaining Need <sup>3/</sup> (1,000)
Conservation Cropping System	Acre	585	1300	6500	731	90	370
Conservation Tillage	Acre	90	200	5000	101	13	313
Crop Residue Use	Acre	490	1090	3270	617	76	228
Grasses & Legumes in Rotation	Acre	180	400	1200	203	25	75
Field Border Planting	Lin.Ft.	58440	130000	13000	73050	9000	900
Contour Farming	Acre	216	480	1440	243	30	90
Grassed Waterways	Acre	11	24	20400	12	2	1275
Diversions	Lin.Ft.	7188	16000	3200	8100	1000	2000
Terraces	Lin.Ft.	43128	96000	9600	48600	6000	600
Stripcropping	Acre	90	200	5000	101	13	313
Wildlife Habitat Devp.	Acre	4	8	800	4	1	50
Cover Crops	Acre	23	50	250	36	4	20
Land Smoothing	Acre	40	90	2250	53	7	163
Surface Drain	Lin.Ft.	22500	50000	30000	32500	4000	2400
Subsurface Drain	Lin.Ft.	37344	83000	66400	52800	6500	5200
Pasture and Hay Planting	Acre	3	84	12500	5	88	13200
Pasture Renovation	Acre	4	93	10300	6	65	7100
Forest Resources							
Salvage	Acre	-	11	1066	-	21	2034
Harvest	Acre	17	131	12690	51	196	18987
Commercial Thinning	Acre	-	86	1966	-	110	2515
Other TSI	Acre	4	121	2766	12	215	4915
Stand Conversion	Acre	7	69	6693	21	109	10573
Idle Cropland	Acre						
Regeneration	Acre	4	28	1745	11	42	2618

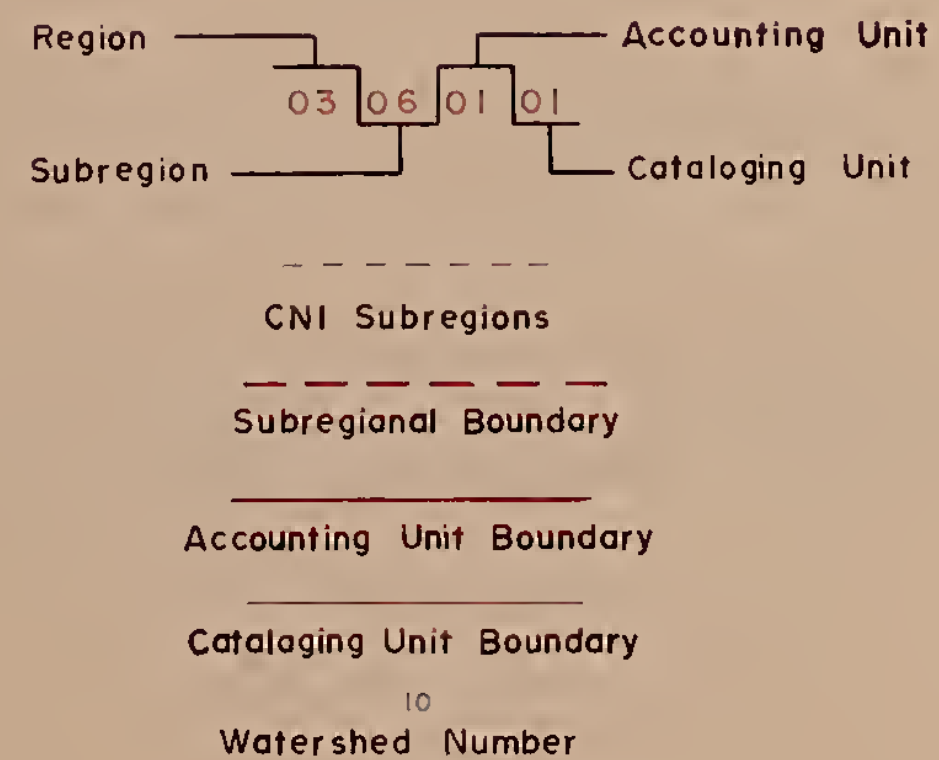
1/ Quantities of conservation measures cannot be added to obtain total land treated.

2/ Overlapping conservation measures may be applied to an individual acre to adequately treat the land.

3/ Needs if accelerated for present to 1990 is accomplished.

3/ Estimated remaining costs excluding cost of on-going program.





Material prepared by Field Personnel. Reproduction  
only by SCS Cartographic Staff, Fort Worth, Texas.

II - I  
CNI WATERSHEDS  
TAR-NEUSE RIVER BASIN  
NORTH CAROLINA

0 10 20 30 40  
APPROXIMATE SCALE

LAMBERT CONFORMAL CONIC PROJECTION, 1:500,000 AND  
W. PRODUCED AT 1:500,000 OR IF 1 INCH EQUALS 1 MILE, 1:500,000  
AND ALSO BY PRODUCTION AT 1:250,000 OR IF 1 INCH EQUALS  
1/2 MILE, 1:250,000 OR IF 1 INCH EQUALS 1/4 MILE, 1:250,000

BASE COMPILED FROM 1:500,000 STATE D152 MAP

REVISED JANUARY 1975 4-P-3201-1 PLATES A8C





## CHAPTER III

### RESOURCE DEVELOPMENT -- SUMMARY STATUS AND IMPLEMENTATION OPPORTUNITIES

#### Introduction

Implementation of any of the various parts of this plan's alternatives will be accomplished through assistance from, and the cooperation of federal, state and local agencies, and interested individuals and other groups. Installation will depend on local units of government organizations to initiate requests for assistance, and their willingness to assume leadership and financial and legal responsibilities. USDA and other federal and state agencies are available to provide technical and financial assistance for implementing elements of alternatives.

There are numerous federal and state government programs available to help remedy existing resource problems in the Tar-Neuse Basin. Application of land treatment measures is a voluntary action accomplished by individual land users or landowners. Other measures such as flood prevention, municipal and industrial water supply, or recreational development, etc., require group or community action.

United States Department of Agriculture agencies have major administrative responsibilities for programs to develop and manage water and related land resource conservation. These agencies include the Soil Conservation Service, Forest Service, Agricultural Stabilization and Conservation Service and Farmers Home Administration. Educational and planning assistance is provided by the Economics, Statistics and Cooperatives Service and the Extension Service.

#### SUMMARY STATUS

##### LAND RESOURCES

The Basin comprises 8,893,000 acres of which 6,208,000 acres are classified as inventory land as defined by the Conservation Needs Inventory (CNI). Inventory land is that land considered potentially available for agricultural use. Current and projected land use for the Basin is displayed in Table III-1.

Soil productivity must be protected and maintained through erosion control measures and reduction of wetness hazards. Land treatment practices available to accomplish this protection include residue and annual cover, contour farming, strip cropping, terracing, diversions, drainage systems, pasture improvement and pasture re-establishment. The application of these measures is necessary to maintain future soil productivity. Status of the land treatment program is listed in Table III-2.



Typical PL-566 watershed flood retention structures creates an area of scenic interest in the landscape in addition to reducing flood damage downstream.



## FOREST RESOURCES

### General

There are 4.2 million acres of forest land in the Basin, representing roughly 58 percent of the Basin's total land area. An estimated 5.5 billion cubic feet of growing stock timber is currently found in Basin forests, with annual growth amounting to 249 million cubic feet (Table III-3, page III-18). The volume of business generated by industrial wood production activities keeps 11,000 people employed each year, contributing \$62 million of income to the Area's economy. As shown in Table III-3, the average net annual growth of Basin growing stock is 59 cubic feet/acre/year.

### Ownership

Ownership of Basin forest lands is distributed among major categories: farmer (51 percent); forest industry (15 percent); miscellaneous other private (26 percent); national forest (3 percent); and other public (5 percent).

### Recommended USDA Forestry Program

A forest land program designed to resolve problems and meet basin forestry activity needs would involve the following:

Increased Wood Production -- At least eight actions would help increase basin wood production outputs. Six of the eight actions are recommended and should be initiated to insure that future long-term demands for industrial wood products are met. In all cases, acreages discussed are scattered throughout the Basin. The six recommended measures are:



- (1) 394,722 acres of merchantable stands that have reached maturity should be completely harvested (clearcut), site prepared and replanted to suitable species.
- (2) 31,825 acres of stands containing timber damaged by insects and diseases, wildfire, weather, etc., should be salvaged through liquidation of all saleable timber, with site preparation and replanting to suitable species following.
- (3) 196,493 acres of stands containing immature, yet merchantable, timber should be commercially thinned to enhance growing conditions and insure desirable future growth rates.
- (4) 205,984 acres of stands comprised of species which are undesirable from the standpoint of industrial wood production should be converted to insure the production of more suitable species growth.
- (5) 352,387 acres of immature stands predominantly comprised of trees of unmerchantable sizes should be selectively thinned to improve stand growing conditions and enhance potential growth rates.
- (6) 85,470 acres of idle cropland should be stocked with desirable tree species. In some cases, natural regeneration may suffice. In other cases, manual planting of pine species may be required.

Two possible timber management actions which are not recommended include drainage treatment of forested wetland sites and regeneration treatment of forested sites having low productivity characteristics. Recommendations regarding such sites, based on environmental quality concerns, are:

- (1) 640,848 acres of poorly-stocked stands found on low productivity sites should be managed for wildlife species best adapted to such sites. Specific management needs should be addressed by wildlife biologists.
- (2) 239,862 acres of forested wetlands are currently considered unsuitable for timber management from a strict wood production standpoint. Having special significance as wildlife habitat, wetland areas will require special attention from, and treatment by, wildlife biologists.

Table III-4 (see page III-18) indicates future total timber treatment activity levels expected under the recommended USDA program as compared to normal levels expected under on-going programs (e.g., without a USDA program). Also shown are total estimated costs and benefits associated with the six recommended treatment actions discussed.

Erosion and Sediment Reduction -- Increased erosion and sediment yields associated with timber management activity can be reduced 10 to 15 percent if certain precautions are taken: (a) incorporate streamside "buffer zones" into logging operation plans; (b) design road and skid trail layouts to minimize disturbance and erosion potentials; and (c) use roller chopping, in place of bulldozing with KG blades, when preparing harvested site for regeneration.

## WATER SUPPLY

Public water supplies within the Tar-Neuse are generally of three types: wells, direct intakes from streams, and impoundments. The type used depends on the size of the town or community, its average water usage, and its location with respect to dependable streams, potential structure sites, etc.

A discussion of each type of water supply source follows. The potential for future development and an inventory of the existing public water supplies within the Basin are included.

The Basin consists of two distinct physiographic regions, the Coastal Plain and Piedmont. There are two major artesian aquifer systems occurring in the Coastal Plain and a surficial water table aquifer system that also occurs over most of the Coastal Plain. The artesian system includes the Cretaceous and Tertiary limestone and sand.

The Cretaceous aquifer is the deepest and the oldest of the aquifers. Well yields from this aquifer range from about 75,000 gallons per day in the western part to 1.5 million gpd in the eastern part. In the tidewater area wells in this aquifer may have a salinity problem. The Tertiary Limestone aquifer is the most productive in the state. Wells constructed for maximum production in this aquifer can yield up to 7 million gallons per day.

The Tertiary sand aquifer system occurs in the northeastern part of the state. It can yield 50,000 - 750,000 gpd but there is usually a salinity problem in much of the area where the thickness and productivity of the aquifer system are greatest.

Surficial sands make up the water table aquifer system and the thickness of the sands ranges from about 10 feet to over 100 feet. Wells yield 15,000 - 500,000 gpd depending on the location and thickness of this aquifer. It is probably the most important aquifer for the smaller domestic water supplies and is important as a recharge source for the artesian aquifer system.

In the Piedmont, the ground water conditions differ from those in the Coastal Plain. The yield of individual wells varies widely in all the aquifers however, ranging from essentially dry holes to several hundred thousand gallons per day. Most wells in the Piedmont section of the Tar-Neuse are constructed for domestic needs that are satisfactorily met by one or two thousand gallon per day yield.

Surface water supplies are direct intakes from either a stream or a lake. A community needs a reliable water supply if it is to provide water service. A reliable surface supply may be obtained from a stream if the stream has sufficient flow during extreme drought periods, or from an impoundment which can store sufficient volume to supplement stream flow during low flow periods.

An inventory of potential impoundment sites in the Tar-Neuse Basin has been made and the data on these sites were published in a potential structure site report. In the future, many of these potential sites can provide anticipated water needs for use by the communities in the Basin if they are not preempted by other land uses.



## WATER QUALITY

Water quality will improve in the future through the efforts of the Federal Water Pollution Control Act Amendments of 1972 (Public Law 92-500) to "restore and maintain the chemical, physical, and biological integrity of the nations waters". According to the Act, "it is the national goal that wherever attainable, an interim goal of water quality which provides for protection and propagation of fish, shellfish, and wildlife and provides for recreation in and on the water be achieved by July 1, 1983".

The 1972 Act Amendments also established a goal of zero discharge of pollution by 1985. It established a comprehensive system of federal and state regulation of the discharge of pollutants into the waters of the United States. The Act required implementation of the "best practical control technology currently available" by July 1, 1977 and will require the application of the "best available technology economically achievable" by July 1, 1983. The state is expected to continue playing a major role in the construction and upgrading of treatment facilities by providing guidance, coordination, technical assistance, and monitoring and enforcement to point discharges.

Section 208 of the Act includes a requirement that plans be developed to reduce or control nonpoint source pollution from various land uses. The regulation identifies the use of Best Management Practices (BMP) as an acceptable method of reducing nonpoint source pollution. Many of the conservation practices land users have been installing to reduce sediments, nutrients and pesticides have been instrumental in improving the state's water quality. The Soil Conservation Service, in cooperation with local soil and water conservation districts, assists land users in developing conservation plans that include treatment systems that have potential for reducing nonpoint pollution sources.

Saline intrusion into aquifers is expected to continue at a slow rate until withdrawal rates are substantially reduced. Under the State Capacity Use Act water use is monitored to determine when restrictions or withdrawals of water, pumping levels in wells, and piezometric surface drawdown are needed and when impairment of water quality standards has occurred. The primary concern of water quality monitoring is to detect the movement of brackish or saline waters into the aquifer system. By contrast, water use is expected to increase significantly in this area in the future; however, without effective water resource conservation management strategies, this resource will be depleted in the future.

This study did not address the problem of water deterioration caused by the introduction of nutrients and pesticides.

## RECREATION

Although the Basin has many areas that could be developed to meet the recreation demands of an increasing population, facilities developed in neither the private nor public sectors are expected to satisfy such demand.



Opportunities exist for extensive development of resources for recreation.

The areas currently being used for outdoor recreation are about 80 percent forested according to the 1973 North Carolina Statewide Comprehensive Outdoor Recreation Plan (SCORP). There are about 500 recreation sites in the Basin which include sightseeing, picnicking, swimming, nature walks, fishing, bird watching, hunting, camping, horse-back riding and canoeing. During 1973 there was an estimated 12.5 million activity days within the Basin. The National Forest within the Basin currently has two camping areas and five picnic areas with a total use of 21.3 thousand visits annually. That forest plan has about 23 thousand visitors annually who are engaged in nature study in dispersed natural, scenic, and historical areas. In addition, it has 18.5 miles of developed nature trails.

Forest recreation will increase as the population increases. The North Carolina's Department of Natural Resources and Community Development (NC DNR&CD) estimates a 20 percent gain in population from 1970 to 1990 and a 49 percent increase from 1970 to 2020. Currently there are about 272,000 forest acres being used for outdoor recreation. By 1990 it will be 326,400 and by year 2020 it will be about 405,300.

As more forest area is demanded for recreation, overall management practices must be modified to permit multiple use and at the same time keep the forest beautiful, useful and enjoyable.

State appropriations to acquire land and water currently needed to satisfy demand will continue. As the Basin's population grows and development spreads into the countryside, many opportunities for outdoor recreation will become more difficult to find and more urgently needed. Those facilities located near population centers will become crowded, access to distant and natural sites more difficult.



## CULTURAL RESOURCES

A variety of state and federal laws, programs, funding sources, and tax incentives exist which can serve as useful tools to individuals, groups, and governmental units seeking to further preservation of historic resources. It is important to remember, however, that these are indeed tools: they have no more effectiveness in and of themselves than does a hammer lying on a tool bench. Only when these tools are handled with skill and persistence by those who seriously seek results can they be productive. Only when the people in a community, private individuals and government, employ these preservation tools can these various laws, incentives, and programs further the goals of preservation in the community, state and nation.

Some tools for preservation are listed below. Still more information may be obtained from sources noted in the Historic and Architectural Resources Report. In addition, there is a list of publications that may be helpful. A great deal of material on preservation can be obtained from the Division of Archives and History and from the National Trust for Historic Preservation Southern Regional Office, 456 King Street, Charleston, South Carolina 29403, (803) 724-4712.

The historic preservation programs of the Heritage Conservation and Recreation Service (HCRS) are authorized principally by the National Historic Preservation Act of 1966, but responsibilities have developed as a result of numerous pieces of legislation. The key documents that have shaped these programs are the Antiquities Act of 1906, the Historic Sites Act of 1935, the National Historic Preservation Act of 1966 as amended in 1976, Executive Order 11593 (1971), the Archaeological and Historic Preservation Act of 1974, the Federal Property and Administrative Services Act of 1949 as amended in 1972, the Tax Reform Act of 1976, and the Revenue Act of 1978.

Executive Order 11593, Protection and Enhancement of the Cultural Environment, emphasizes a leadership role for federal agencies in preserving, restoring, and maintaining the historic and cultural environment. The order directs agencies to survey, inventory, and nominate to the National Register all historic resources within their control.

The Archaeological and Historic Preservation Act of 1974 authorizes the recovery, protection, and preservation of historic and archaeological data threatened by federal projects.

The Federal Property and Administrative Services Act as amended authorizes the General Services Administration to convey surplus federal property to any state agency or municipality free of charge for use as a historic monument for public benefit.

A 1976 amendment to the National Historic Preservation Act of 1966 established a National Historic Preservation Fund based on revenues from mineral leasing on public lands and the Outer Continental Shelf. In addition, it extends protection to properties determined to be eligible for inclusion in the National Register as well as those already listed.

The Tax Reform Act of 1976 as amended and the Revenue Act of 1978 provide federal income tax incentives to encourage the rehabilitation and discourage the demolition of commercial or business-related buildings. These structures must be listed in the National Register.

#### AREAS OF NATURAL BEAUTY

Areas of natural beauty, environmental corridors and open space should be managed to enhance man's environment and the enjoyment it provides. Many of the potential areas including wetlands, estuaries, water-land interfaces, urban spaces and streams are being lost by urban expansion, road construction, and other public projects. State and/or federal strategies are needed to make the public aware of the resources and a reasonable percentage of the potential areas must be reserved for public use.

#### FISH AND WILDLIFE

Land use changes expected to occur in the Basin will have the greatest effect on fish and wildlife habitat in the future. The greatest threat to wildlife habitat is the conversion of forest land to cropland. Land use conversion problems have the greatest impact on the natural environment when acreages to be cleared are wetlands. The conflict occurs because much of the productive land for crops such as corn and soybeans can also be classified as wetlands under current definitions.

### IMPLEMENTATION OPPORTUNITIES

#### Introduction

Protection and development of the Basin's resources can be accomplished through the assistance of a number of programs, both USDA and non-USDA. A discussion of the implementation opportunities follow:

#### LAND TREATMENT OPPORTUNITIES

Conservation land treatment is a basic element in formulating the watershed program. It is defined as applying management, cultural, and structural practices in such a manner that the land is used within the limits of its capabilities and soil losses from erosion are held to acceptable levels. Land treatment is accomplished primarily through the development and implementation of conservation plans.

Conservation plans on individual units of land are documents that guide deliberate actions to accomplish land treatment. Conservation planning involves the use of inventory data for study, evaluation, and selection of the future courses of action. Each conservation plan is tailored to fit a particular unit of land by the landowner or landuser with planning

assistance of a soil conservationist with the SCS. The soil conservationist provides technical material and information on soils, water, animals, and plants which are needed by the landowner or landuser in the decision-making process.

Technical assistance for land treatment is provided by SCS under authority of Public Law 46, 74th Congress. Assistance is given to landowners and operators through requests to local soil and water conservation districts. Financial assistance is available through the Agricultural Conservation Program (ACP) to install erosion control measures and other pollution control measures. The Agricultural Stabilization and Conservation Service administers the Agricultural Conservation Programs.

To fully develop and utilize the soil resource, application of land treatment is currently needed on 1.3 million acres. This represents 21 percent of the total inventory lands. The remaining 79 percent, or 4.9 million acres is considered adequately treated.

#### WATERSHED DEVELOPMENT OPPORTUNITIES

Local sponsorship is required for watershed development. The Soil Conservation Service, under authority of Public Law 83-566, as amended, provides technical and financial assistance to state and local organizations. Assistance is for watershed protection, flood prevention, fish and wildlife enhancement, public recreation, irrigation and drainage. Loan assistance is available to provide funds for developing municipal and industrial water supplies. The status of watershed project measures in the Basin is listed in Table III-5 (see Map III-1).

The opportunity to reduce land and water resource problems can be accomplished through 46 PL-566 watersheds found to be economically feasible. These watersheds, along with potential projects in three RC&D areas, were divided into two groups...early action and long range. Eleven PL-566 early action projects were identified as having either considerable local interest, preliminary work started, or planning authority approval. Completion of these is expected in 1990. An additional 35 long range PL-566 projects, where local interest has not yet been expressed and, as previously discussed, are scattered through the Basin (see Table A-6).

Future watershed development would provide for the implementation of a combination of structural and land treatment measures established in a watershed plan. Structural measures including embankments and channel work result in flood damage reduction and improved drainage. Some recreational benefits would occur.

Conservation land treatment measures would be installed at an accelerated rate through local soil and water conservation districts. Land owners or users are responsible for the installation of conservation measures with technical assistance furnished by the Soil Conservation Service. Financial assistance can be obtained from the Agricultural Stabilization and Conservation Service, Farmers Home Administration, and PL-566 project funds.



## RESOURCE CONSERVATION AND DEVELOPMENT AREA OPPORTUNITIES

Section 102 of the Food and Agriculture Act of 1962, Public Law 87-703, as amended, provides the Soil Conservation Service with authority to assist local people in planning and carrying out resource conservation and development projects. The locally initiated and sponsored projects are designed to promote orderly conservation, improvement, development, and wise use of natural resources. Portions of three Resource Conservation and Development areas (RC&D) are in the Basin (see Map III-2).

Financial and technical assistance for certain measures is available through each of the RC&D areas in the Basin. However, assistance is available only in the Basin counties that are within project areas. An RC&D Council, consisting of Soil Conservation Districts, Commissioners, etc., is responsible for all aspects of the program.

Mid-East RC&D Area - This area consists of five counties (Beaufort, Pitt, Martin, Bertie and Hertford). Beaufort and Pitt Counties are entirely within the Basin. Major measures planned include (1) adequate treatment of eroding land with permanent vegetation and necessary supporting structural measures, (2) multi-phase erosion control work on rural roadsides, (3) efforts to improve public access to recreation resources and improve facilities through emphasis on water-based recreation developments, and (4) financial and technical assistance to community groups to help improve flood conditions, septic systems, stagnated mosquito breeding pools, unsafe drinking supplies and unclean living conditions in community areas.

Albemarle RC&D Area - This area consists of ten North Carolina counties, (Camden, Chowan, Currituck, Dare, Gates, Hyde, Pasquotank, Perquimans, Tyrrell and Washington). Of these counties, Dare, Hyde, and Washington Counties are partially in the Tar-Neuse River Basin. The RC&D plan was completed in 1977 and the major measures planned include a water-based recreation facility, critical area seeding, and roadside critical area treatment.

North Central Piedmont RC&D Area - This the oldest RC&D area in North Carolina and is comprised of seven counties. A portion of Orange County is the only part of the area that is in the Basin. Major measures planned include those for: beautification, erosion control, fish and wildlife enhancement, flood prevention, recreational development, highways improvement, outdoor education, school property improvement, rural water supplies, sediment abatement, forestry improvements, public hunting and fishing.

## FORESTRY DEVELOPMENT OPPORTUNITIES

The Forest Service is responsible for administering National Forest Programs and providing assistance through cooperative programs. There is one National Forest, the Croatan, in the Basin.

The Forest Service cooperates with the North Carolina Division of Forest Resources to provide programs, funding and services for the following:



- (1) CM-2 Program - Basic protection from forest fires. Federal funds for this protection are provided under this program.
- (2) FI&DM Program - Basic protection from insects and diseases.
- (3) CFM Program - Technical assistance for multi-purpose management and product utilization/marketing.
- (4) CM-4 Program - Assistance in production and planting of trees on private non-federal public lands.
- (5) FIP Program - Cost sharing for planting trees for timber production, for improving the environment and improving a stand of forest trees in conjunction with the state ASCS Committee and in consultation with the state forester.

#### OPPORTUNITIES FOR OTHER USDA PROGRAMS

Opportunities for implementation and resource development are available through other USDA agencies including the Farmers Home Administration, the Agricultural Stabilization and Conservation Service, as well as the Cooperative Extension Service.

The Farmers Home Administration provides credit and technical management assistance to rural people, public agencies, and non-profit organizations to facilitate conservation, development, and utilization of water and related land resources. The Farmers Home Administration (FmHA) programs include:

- (1) Water and waste disposal loans
- (2) Farm ownership loans
- (3) Recreation enterprise loans
- (4) Irrigation and drainage loans
- (5) Soil and water conservation loans for financing land and water development measures
- (6) Resource conservation and development loans for measure contributing to conservation, development and improvement of natural resources and economic conditions

The Agricultural Stabilization and Conservation Service administers certain production adjustments, resource protection, and related farm income stabilization programs. Programs include:

- (1) The Cropland Adjustment Program, which provides cost-share assistance for shifting cropland to protective conservation uses under long-term agreements.
- (2) The Agricultural Conservation, Rural Environmental Assistance, and Rural Environmental Conservation Programs, which provide cost-sharing assistance to land operators in applying resource conservation and environmental improvement practices.

(3) The Production Adjustment, Conservation, Crop Conservation and Commodity Disposal and Inventory Operation Program to assist in stabilizing farm prices and income, regulate commodity production, and conserve natural resources.

(4) Objectives of the Water Bank Program are to conserve waters; preserve and improve migratory waterfowl habitat and wildlife resources; and secure other environmental benefits.

The Cooperative Extension Service is the educational arm of the US Department of Agriculture in cooperation with the land grant colleges and universities. Federal, state, and county levels of government assist in financing, planning, and carrying out information and educational programs. County agents and agencies and groups assist in providing the public with information relating to agricultural programs.

#### SPECIAL STUDY AREAS

##### Tar River Above Louisburg - Sediment Reduction Report

A request was received from the NC Department of Natural Resources and Community Development (NC DNR&CD) to the Soil Conservation Service (SCS) to study, as a part of the Tar-Neuse River Basin Study, alternatives for the reduction of sediment transported by the Tar River above US 401 at Louisburg, North Carolina.

Land use was determined from the North Carolina Conservation Needs Inventory, which presented land use in 1967. The Erosion and Sediment Inventory for North Carolina also used 1967 data for erosion and sedimentation rates. Cropland acres had been declining until 1967 but a leveling off and even an increase in cropland and pasture acres occurred in 1976. Urban land continues to increase.

Land use is changing from cropland, pasture, and forest to urban, industrial, roads and highways, residential and small water. 1967 data showed the following land uses: 23 percent cropland, 6 percent pasture, 61 percent forest, 4 percent other land, 4 percent urban, 1 percent federal, and 1 percent small waters.

Two-thirds of the average annual gross erosion is occurring on cropland, with an additional 29 percent from other land producing a total of 1,722,628 tons of sediment from 73,715 acres (an average annual rate of 23.3 tons per acre, or 96.5 percent of the erosion is occurring on 27 percent of the land area).

The sediment delivery ratio for this land resource drainage area is estimated to be 32 percent of the average annual gross erosion. This means 32 tons of sediment are delivered to waterways of the drainage area for each 100 tons of gross erosion.

Of the 1,722,628 tons of calculated annual erosion, 551,240 tons of sediment reach of waterways of the Tar River above US 401 at Louisburg, North Carolina annually at 1967 rates.

The solution for sediment reduction in the Tar River at Louisburg to an acceptable concentration level is a considerable undertaking in time, effort and money. There are more than 60,100 acres of cropland and 6,360 acres of other land with erosion rates greater than 4 tons per acre per year.

Assuming all pasture and forest lands are eroding at a rate of less than 4 tons per acre per year, there are still 76,384 acres (or 27.9 percent of the land) producing 94 percent (or 399 acre feet) of sediment annually.

If the erosion on 66,462 acres of cropland and other land were reduced to an average of 4 tons per acre per year, then the sediment would be reduced to 90 acre feet per year. This would be an 80 percent reduction of the sediment in the waterways.

To accomplish this objective, all lands would require conservation treatment equal to 1967 conditions in addition to adequate conservation protection on all cropland and other land.

Practices needed for adequately protecting the 60,100 acres of cropland are estimated as:

Conservation Cropping System	60,100 acres
Stripcropping	15,025 acres
Crop Residue	48,080 acres
Conservation Tillage	15,025 acres
Contour Farming	36,060 acres
Grassed Waterways	18,030 acres
Field Borders	6,010,300 feet
Terraces	12,020,600 feet
Diversions	1,202,000 feet

Practices needed for adequately protecting the 6,360 acres of other land are estimated as:

Waterways	510 acres
Diversions	636,000 feet
Surface Shaping & Smoothing & Seeding	3,180 acres

An alternative to land treatment would be the addition of reservoirs to trap a portion of the sediment before delivery to the Tar River. The 19 potential reservoir sites would entrap sediment from approximately 52 percent of the watershed areas and would provide storage for 11,900 acre feet of sediment. Along with the sediment storage, these 19 structures as flood retarding structures have approximately 47,500 acre feet of flood storage.

The sediment stored in the proposed structure sites would benefit the water resources of the entire Tar River and benefits may extend into the coastal waters. An estimated 11,409 acre feet over a 100 year period



would materially reduce the filling of the river channel and associated municipal reservoirs with sediment. The beneficial effects of sediment storage could also extend to the fishing resources of the coastal waters.

This study of the Tar River Basin above Louisburg indicates the area is one of the most severely eroded areas in North Carolina. In order to change the erosion process occurring in these upper Tar River Basin problem areas, a plan will need to be developed to provide an orderly process establishing the proper land treatment measures. The plan should identify the erosion areas to be treated by priority with the highest erosion area listed first. The plan should identify land treatment measures required in each erosion area and should detail the method by which the necessary treatment measures will be installed.

#### Neuse River Above Falls Reservoir

A parallelism of conditions and problems exist in the drainage area of Falls Reservoir on the Neuse River. Solutions to the erosion and sediment problems here would be similar to those presented for the Louisburg Study. Erosion areas will need to be identified and required land treatment measures established.

#### OPPORTUNITIES FOR NON-USDA PROGRAMS

Other federal and state agencies have major responsibilities for programs and projects that affect the development, management and utilization of the Basin's water and related land resources. These include the Corps of Engineers, Fish and Wildlife Service, Heritage Conservation and Recreation Service, Environmental Protection Agency, and the Federal Emergency Management Agency. State agencies include the Department of Natural Resources and Community Development, North Carolina Office of Water Resources, North Carolina Division of Soil and Water Conservation, and the North Carolina Division of Archives and History.

The Corps of Engineers has major responsibilities for programs and projects that affect the development, management and utilization of the Basin's water and related land resources.

The Corps of Engineers also undertakes planning for long-term coordinated development of the water resources of entire river basins. Investigations by the Corps include consideration of navigation, flood control, generation of hydroelectric power, water conservation, domestic and industrial water supply, water quality management protection of fish and wildlife, recreation, protection (enhancement) of environmental quality, and other potential uses of water.

The Fish and Wildlife Service conducts research and provides grants, services and assistance to states and other agencies to perpetuate the enhancement of fish and wildlife resources. In the Tar-Neuse Basin, this agency cooperates with North Carolina departments in carrying out fish and wildlife conservation and management programs.



The Heritage Conservation and Recreation Service provides assistance to states in assessing needs, identifying outdoor recreation opportunities, and planning and developing additional projects. This agency also provides land and water conservation grants to states and appropriate political subdivisions for outdoor recreation planning, land acquisition, and facility development. HCRS administers the National Historic Preservation Program.

The Environmental Protection Agency is the prime regulatory, research, and educational agency of the federal government having responsibility for protecting and improving the environment. This agency has wide responsibilities including researching, developing, and enforcing standards for emissions and effluents; evaluating and registering pesticides; controlling toxic and poisonous substances; and developing new methodology in pollution control. The agency works with other public and private agencies or groups on matters concerning the environment.

Federal flood insurance programs are administered by the Federal Emergency Management Agency (FEMA). Also, the agency is responsible for functions relating to dam safety.

The Secretary of the Department of Natural Resources and Community Development for North Carolina has instigated a program to cost share with individual private forest landowners. Called the North Carolina Forest Development Program, it includes any work needed to establish a new forest and to release seedlings and sprouts providing the landowner has an approved management plan.

The Office of Water Resources is part of the North Carolina Department of Natural Resources and Community Development. The office has wide range of activities ranging from immediate implementation of specific development projects to long range planning studies.

In addition, the office also provides the following services:

1. Maintains active liaison in connection with studies of federal agencies such as USDA and the Corps of Engineers. It also takes part in interstate planning activities such as the Yadkin-Pee Dee Level B Study.
2. Has an active program designed to increase our knowledge of ground and surface water hydrology and better manage the state's water resources.
3. Maintains inventories of water resources of the state, prepares periodic projections of water demands, and devises long range plans to insure the balanced development of the resource.
4. Works closely with public water supply systems which desire technical assistance to devise plans to meet present or anticipated shortages.

5. Oversees the distribution of state grants-in-aid for Civil Works Projects of the Corps for small water resources development projects sponsored by local governments.

6. Serves as the coordinator of the NC Flood Damage Reduction Task Force (state and federal agencies) and provides flood damage reduction planning assistance to local governments.

The Division of Soil and Water Conservation is part of the North Carolina Department of Natural Resources and Community Development. It has the responsibility of assisting the 92 Soil and Water Conservation Districts across the state with their local programs. In addition, the Division has the responsibility for rendering technical aid for accelerating the planning and operations process of PL 83-566; for coordinating the acceleration of the modern soil survey; and for the preparation of the 208 Agricultural Non-point Pollution plan.

The North Carolina Division of Archives and History, in the Department of Cultural Resources, is charged with encouraging historic preservation activities on a statewide basis. This office nominates properties to the National Register of Historic Places, awards matching grants for survey and planning activities for acquisition and development (restoration and rehabilitation) projects, advises federal agencies on their responsibilities for protection of historic resources, coordinates the certification process for the tax-related programs, and disseminates information for the Administrator, Archaeology and Historic Preservation Section, Division of Archives and History, 109 East Jones Street, Raleigh, North Carolina 27611, (919) 733-4763.

TABLE III-1  
LAND-USE PROJECTIONS<sup>1/</sup>  
TAR-NEUSE RIVER BASIN  
NORTH CAROLINA

<u>Land Use</u>	<u>1970</u>	<u>1990</u>	<u>2020</u>
Cropland	1,775,000	1,612,000	1,884,000
Pasture	242,000	196,000	187,000
Forestland	4,191,000	4,072,000	3,545,000
Federal	356,000	409,000	409,000
Urban and Built-Up	310,000	455,000	531,000
Other	413,000	513,000	641,000
Water	1,606,000	1,636,000	1,696,000*
<b>TOTAL</b>	<b>8,893,000</b>	<b>8,893,000</b>	<b>8,893,000</b>

<sup>1/</sup> Based on historical trends, OBERS-E Projection, Forest Service RB-SE-33

\* Projects known or under construction.

TABLE III-2  
STATUS OF LAND TREATMENT PROGRAM (1976)  
TAR-NEUSE RIVER BASIN  
NORTH CAROLINA

<u>Item</u>	<u>Adequately Protected<sup>1/</sup></u>	<u>Adequately Treated<sup>2/</sup></u>
<b>LAND USE</b>		
Cropland	730,000	470,000
Pasture	140,000	65,000
Forest	3,850,000	2,200,000
Wildlife	420,000	330,000
Recreation	30,000	20,000
Urban and Other	330,000	250,000

CONSERVATION LAND TREATMENT APPLIED

	<u>Acres</u>
Residue and Annual Cover	980,000
Contour Farming	210,000
Stripping, Terracing, Diversions	190,000
Drainage Systems	540,000
Pasture Improvement	110,000
Pasture Re-establishment	210,000

<sup>1/</sup> Land Adequately Protected - Land is adequately protected when those conservation practices and management systems necessary to arrest or prevent deterioration and maintain the productive capability of the resource base have been installed. This means that soil erosion and other factors that influence the sustained productive use of the resource are within acceptable limits.

<sup>2/</sup> Land Adequately Treated - Land is adequately treated when the planned conservation practices and management systems in excess of those necessary to prevent deterioration and maintain the productive capability of the resource have been applied. This could include conservation treatment that is effective in enhancing the environment or increasing productivity of the resource.



TABLE III-3  
NET ANNUAL GROWTH AND REMOVALS FROM GROWING STOCK  
BY SPECIES GROUP  
TAR-NEUSE RIVER BASIN, NORTH CAROLINA -- 1974

Species Group	Net Annual Growth (million bd.ft.)	Growth/ Acre (bd.ft.)	Annual Removal (million bd.ft.)	Removal/ Acre (bd.ft.)
Softwood	140	33	139	33
Hardwood	109	26	76	18
TOTAL	249	59	215	51

SOURCE: USDA-Forest Service, Southeastern Forest Experiment Station

TABLE III-4  
FOREST LAND TREATMENT, COSTS AND BENEFITS WITHOUT A  
USDA PROGRAM AND WITH A USDA PROGRAM 1990, 2020  
TAR-NEUSE RIVER BASIN, NORTH CAROLINA

Without USDA Program		With USDA Program	
32,069	acre treatment	478,225	acres
\$2,671,000	cost	\$29,587,000	cost
\$7,018,000	benefit	\$72,866,000	benefit
94,089	acre treatment	737,656	acres
\$7,923,000	cost	\$46,526,000	cost
\$20,710,000	benefit	\$122,234,000	benefit

SOURCE: Forest Resource Report, Tar-Neuse River Basin, August, 1980

TABLE III-5

STATUS OF WATERSHED PROJECTS  
TAR-NEUSE RIVER BASIN, NORTH CAROLINA

MEASURES

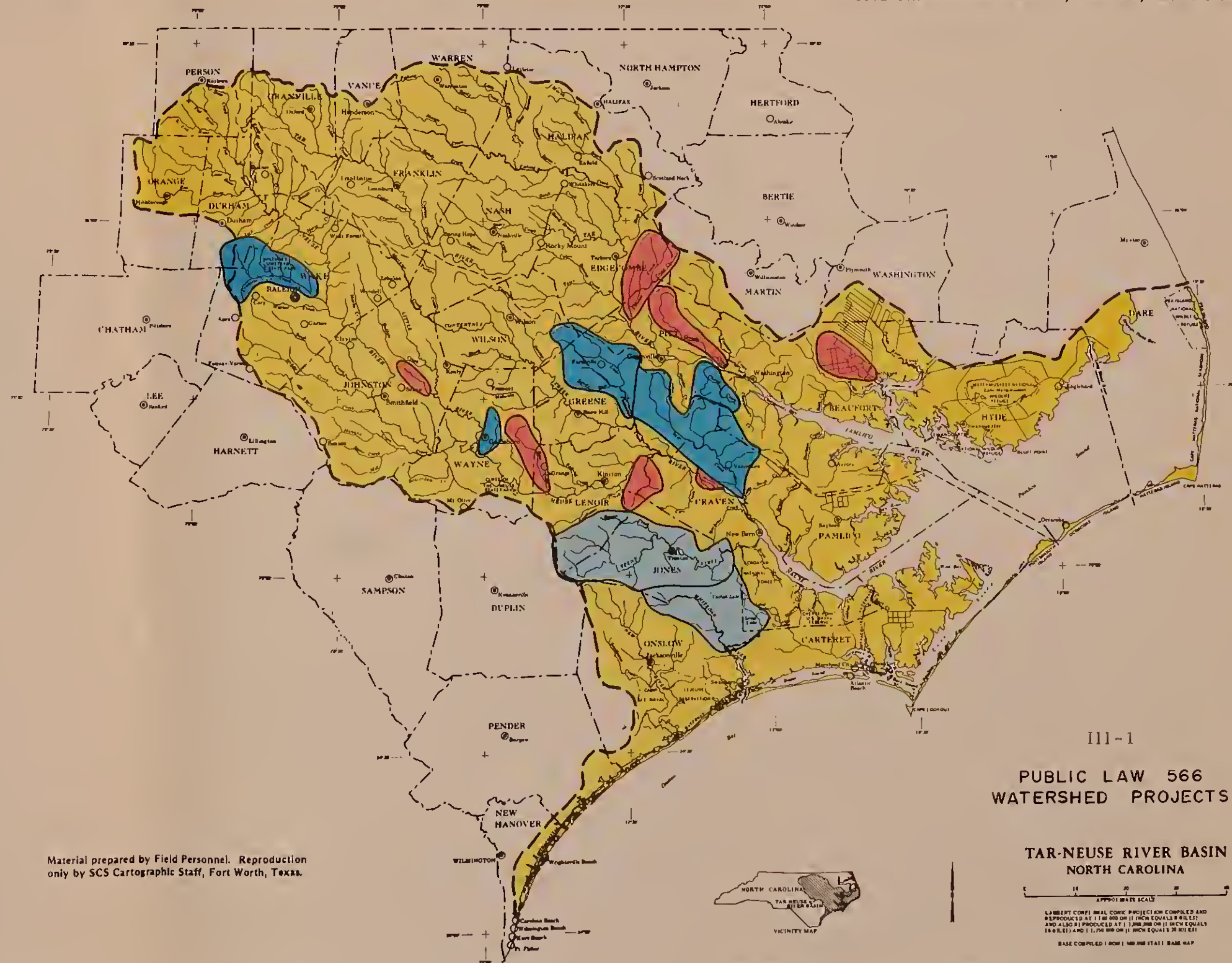
<u>Projects Completed</u>	Drainage Area (sq. mi.)	<u>PLANNED</u>		<u>INSTALLED</u>	
		<u>Str.</u> (no.)	<u>Chan.</u> (mi.)	<u>Str.</u> (no.)	<u>Chan.</u> (mi.)
Bear Creek	60.39	7	22.6	7	22.6
Broad Creek	58.86	0	45.6	0	45.6
Conetoe Creek	100.22	0	95.0	0	45.0
Grindle Creek	80.05	0	28.5	0	28.5
Johnson Milltail	20.62	0	21.0	0	21.0
Moccasin Creek	11.59	0	22.4	0	22.4
Mosley Crk-Tracy Swamp	56.84	0	37.0	0	37.0
<hr/>					
SUBTOTAL	388.57	7	272.1	7	222.1
<hr/>					
<u>Projects Authorized for Construction</u>					
Chicod Creek	54.84	0	60.0	0	0
Crabtree Creek	141.80	11	xx	6	3.2
Lt. Contentnea Crk.	179.93	0	xx	0	0
Stoney Creek	27.50	3	0	0	0
Swift Creek	176.56	0	185	0	0
<hr/>					
SUBTOTAL		14	245.0	6	3.2
<hr/>					
TOTAL	969.20	21	517.1	13	225.3

xx - Being restudied.

SOURCE: Watershed Status Report for North Carolina, 1978.

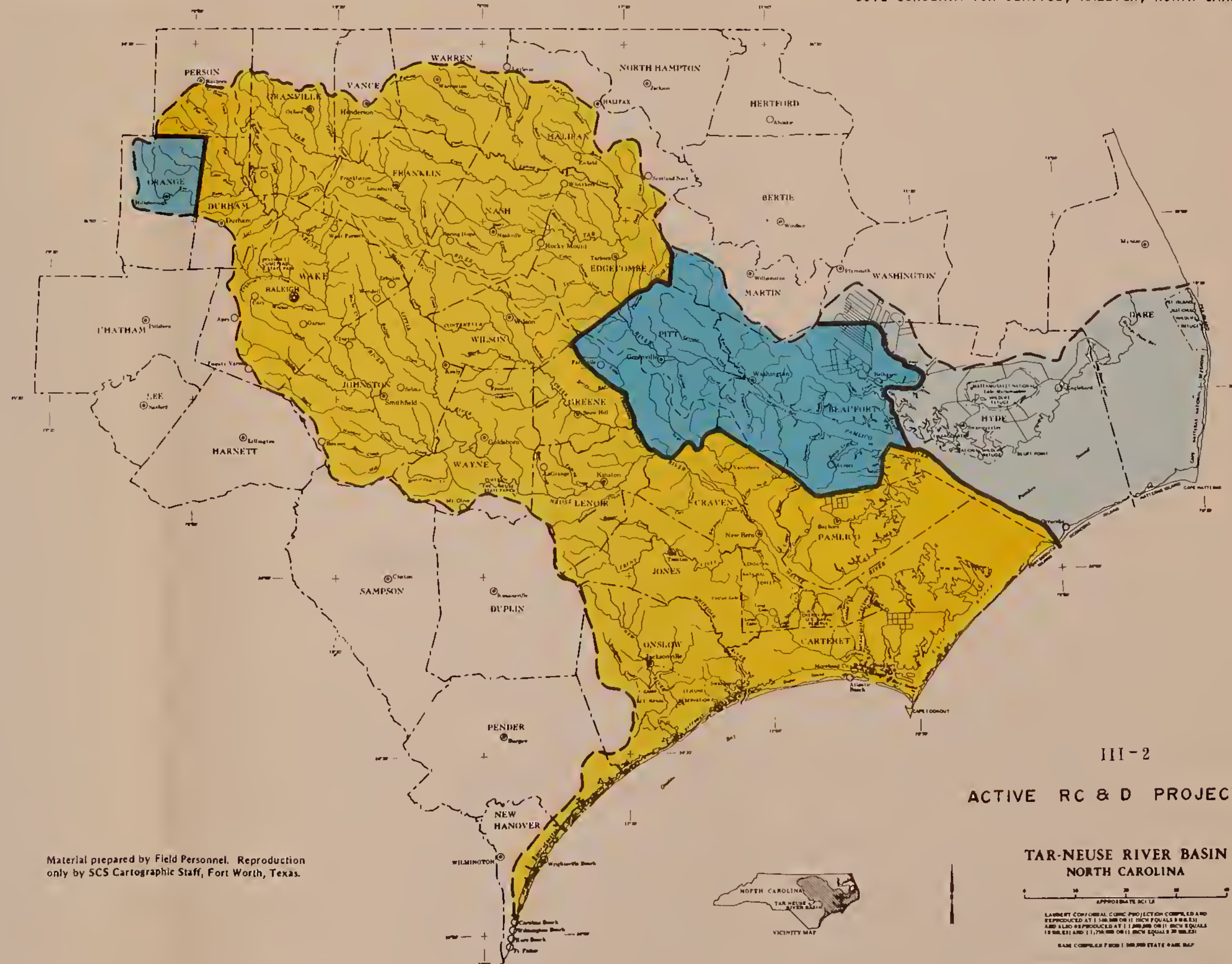












LEGEND

- NORTH CENTRAL PIEDMONT
- MID EAST
- ALBEMARLE

Material prepared by Field Personnel. Reproduction only by SCS Cartographic Staff, Fort Worth, Texas.

III-2  
ACTIVE RC & D PROJECTS

TAR-NEUSE RIVER BASIN  
NORTH CAROLINA

0 10 20 30 40  
APPROXIMATE MILES

LAURENT COPY ORIGIN: CONIC PROJECTION COMPILED AND REPRODUCED AT 1:50,000 OR 11 INCH EQUALS 8 MILES AND ALSO REPRODUCED AT 1:250,000 OR 11 INCH EQUALS 18 MILES AND 1:1,000,000 OR 11 INCH EQUALS 80 MILES  
BASE COMPILED FROM 1:50,000 STATE PLAT MAP

REVISED JANUARY 1975 6-8-30012 PLATED AS C





# **APPENDIX A**



# TAR-NEUSE RIVER BASIN STUDY

## NORTH CAROLINA

### APPENDIX -- RESOURCE BASE

	<u>PAGE</u>
REPORTS .....	A-1
LOCATION AND SIZE .....	A-1
CLIMATE .....	A-1
LAND .....	A-2
Basin Area .....	A-2
Physiography .....	A-2
Soils .....	A-2
Geology .....	A-3
Land Use .....	A-3
Prime Farmland .....	A-4
Prime Forest Land .....	A-4
WATER RESOURCES .....	A-4
Surface Water .....	A-4
Ground Water .....	A-5
Use and Management .....	A-5
ECONOMIC RESOURCES.....	A-5
Population .....	A-5
Employment, Labor Force and Income .....	A-6
Urban Centers and Influence .....	A-8
Agriculture and Related Economic Activity .....	A-9
Number and Size of Farms .....	A-9
Agricultural Production .....	A-10
Livestock .....	A-10
Forest Resources .....	A-10
RECREATION RESOURCES.....	A-12
BIOLOGICAL RESOURCES .....	A-12
Wildlife Resources .....	A-12
Wetland Habitat .....	A-13
Fishing Streams .....	A-13
Flat Water Fishery .....	A-13

## TABLE OF CONTENTS

### APPENDIX-Continued

	<u>PAGE</u>
AREAS OF NATURAL BEAUTY.....	A-14
Natural Areas and Scenic Streams .....	A-14
CULTURAL RESOURCES .....	A-14
Archaeological, Architectural, and Historic .....	A-14
ELEMENTS INCLUDED IN ED AND EQ .....	A-14

### T A B L E S

#### Number

A-6	Tabulation of Elements Included in The Economic Development Alternative, 2020 .....	A-15
A-7	Tabulation of Elements Included in The ED and EQ Alternatives .....	A-17
A-8	Proposed RC&D Project Measures for ED .....	A-18
A-9	Proposed RC&D Project Measures for EQ .....	A-20

### M A P S

#### Number

A-1	Tar-Neuse River Basin
A-2	Average Stream Discharge
A-3	Average Annual Precipitation
A-4	General Soil Map
A-5	Soil Resource Groups
A-6	Geology Map
A-7	Prime Farmland
A-8	Multi-County Planning Regions
A-9	Major Centers of Population
A-10	Black Bear Distribution
A-11	Deer Population
A-12	Wild Turkey Distribution
A-13	Proposed Scenic and Recreational Streams



# TAR-NEUSE RIVER BASIN STUDY NORTH CAROLINA

## REPORTS

Additional information, in greater detail than contained in this report, can be obtained through review of the following sub-reports:

1. Agricultural and Forestry Economic Characteristics (April 1975)
2. Air Resources and Air Quality (July 1977)
3. Erosion and Sedimentation (May 1978)
4. Forest Resource Report (April 1980)
5. Historic and Architectural Resources (February 1977)
6. Inventory of Land and Water Resources and Projected Needs ( )
7. Potential Structure Sites (June 1975)
8. Population, Employment and Income Projections (June 1975)
9. Shoreline Erosion Inventory (May 1980)
10. Soil Productivity Groups (April 1975)
11. Special Studies
  - (a) Hyde County Flood Control and Drainage (June 1975)
  - (b) Lake Phelps Study (June 1975)
12. Wildlife Resources (November 1974)

For information concerning the above reports, contact the Soil Conservation Service, Post Office Box 27307, Raleigh, North Carolina 27611.

## LOCATION AND SIZE

The Tar-Neuse River Basin is located entirely in eastern North Carolina (see Map A-1) between the Roanoke and Cape Fear River Basins. The hydrologic area covers approximately 13,895 square miles within the state boundaries. It encompasses either all or part of 29 counties. The area is almost 200 miles long, ranges from 55 to 90 miles in width through most of its length and includes about 26 percent of the area of the state. The Basin originates in Person County where the streams flow over rocky shoals and some rapids are found. Stream flow in the lower portion of the Basin is sluggish (Map A-2). Elevations in the Basin range from 800 feet in Person County to sea level at the Outer Banks.

## CLIMATE

The climate of the study area is characterized by warm summers and mild winters. Temperatures seldom drop below zero during winter, and occasionally reach or exceed 100°F during summer. Temperatures are affected by air masses that circulate over the Atlantic Ocean, and by air masses that move up from the southwest. The Appalachian Mountains, located west of the study area, form a partial barrier to the cold air masses moving southeastward from the interior of the country.

Rainfall within the Basin varies from about 45.5 inches at Henderson to 56 inches at Beaufort, with an average of 47 inches (Map A-3). July, with a rainfall of about six inches, is the wettest month. October, the driest month, has about half as much. The rainfall is fairly evenly distributed over the remaining ten months. One or more tropical storms cross the Basin almost every year. All these storms yield heavy rainfall and many are accompanied by strong winds. The eastern half of the Basin is most frequently affected.

The climate across the Basin is considered mild. Average annual temperatures range from 60° F in the upper part of the Basin, to 64° in the lower coastal area of the Basin. The average January temperatures for the same areas are 42° and 48°, while the warmer July temperature ranges from 78° to 80°. The freeze-free period ranges from 200 days in the upper Basin to 260 days in the lower reaches.

#### LAND

Basin Area - The hydrologic area is composed of the Tar and Neuse River Basins and an area that drains directly into Onslow Bay. This general region is identified as Water Resources Subregion 0302 by the Water Resources Council. The Tar River originates in Person County and flows southeast to become the Pamlico River at Washington, North Carolina. Fishing Creek and Swift Creek, the largest tributaries, flow into the Tar River at Tarboro. The Neuse River begins where the Eno, Flat and Little Rivers merge in Durham County. Contentnea Creek and Little River in Johnston and Wake Counties are its largest tributaries. The Tar-Neuse River Basin drains into Pamlico Sound. The major tributaries of the area draining into Onslow Bay are Newport, White Oak, and New Rivers.

Physiography - The Basin lies in two physiographic regions that differ considerably in topography, geology, and hydrology. The Coastal Plain region makes up about 72 percent of the area with the remainder in the Piedmont region. The entire basin has a general surface slope toward the southeast and most of the streams, therefore, flow in that direction. The topography ranges in elevation from sea level in the estuaries of the Tar-Neuse River up to 800 feet above sea level in the Piedmont region.

Soils - The Soil Conservation Service and the North Carolina State University have prepared maps of each county showing general soil associations. These maps were used to prepare the General Soil Map of the River Basin (Map A-4). It should be noted that the soil groups are very general and do not provide detailed information about individual farms or small tracts of land. Their uses are also limited for site planning. Detailed soil surveys have been completed for Orange, Durham, Wake, Wayne, Lenoir, New Hanover, Pitt, Edgecombe and Greene Counties. Field mapping is complete in Vance and Washington Counties. Modern surveys are underway in Johnston, Nash, Wilson, Martin, Beaufort, Craven, Pamlico, Jones, Carteret and Onslow Counties. Surveys for Person, Pender, Granville, Warren, Halifax, Franklin, Hyde and Dare Counties have not started as of May, 1980.

When completed, soil survey reports give detailed information on soil limitations for land uses such as residential, commercial, roads, recreation, agriculture and forestry. Copies of published soils reports and some of the unpublished data can be obtained at Soil Conservation Service field offices located in each county.

Soils in the Basin have been grouped in Soil Resource Groups (SRG) or, as they are occasionally called, Soil Productivity Groups (SPG). A SRG is a group of soils having similar cropping patterns, yield characteristics, responses to fertilizer, and management land treatment measures. These SRG's have been mapped using the general soils map as a guide. The dominant SRG's in the Basin are shown on Map A-5.

Geology - The western three-quarters of the Piedmont area is underlain primarily by granites and gneiss with lesser amounts of Triassic shales and sandstones. The eastern one-quarter of the Piedmont area consists mainly of metavolcanic slates, schists, and phyllites. Toward the east, the metavolcanics become covered by clay and sand of the Coastal Plain strata. Rocks of the Piedmont have been altered by various physical and chemical processes so that a moderately deep zone of reddish soil and soft decayed rock is characteristic of the region. The surface is rolling to hilly in many places, especially near the streams, but broad upland areas and long ridges are also common where the rocks are more resistant to erosion.

The Coastal Plain region is underlain by sedimentary rocks--chiefly sand, clay, and limestone--but the surface is generally covered by light-colored loose, sandy soil. From the fall line to the vicinity of Kinston and Greenville, the Coastal Plain surface is gently to moderately undulating, but slopes are steep at many places near the larger streams. The land is generally well drained but alluvial bottoms are found along the creeks (Map A-6).

Southeast of Kinston and Greenville, the stream gradients are so low that natural drainage is inadequate. Extensive pocosins exist in the area. Although the area was uplifted from the sea in recent geologic time, it has been drowned to some extent since the drainage was established, creating many salt marshes and estuaries, or drowned rivers.

Several long barrier islands, offshore bars, and other coastal land forms have been built by wave action and ocean currents some distances from the mainland. The barrier islands, known as the "Outer Banks", have typical sand dune topography. The action of wind and waves during violent storms effects great changes in the physiography of the Outer Banks.

Land Use - Present (1970) land use in the Basin includes cropland (1,775,000 acres), pasture (242,000 acres), forest land (4,191,000 acres), federal (356,000 acres), urban and built-up (310,000 acres), other (413,000 acres) and water (1,606,000 acres).



Prime Farmland - Nationally, as well as locally, there is concern about the amount of agriculturally productive land available to produce food and fiber. Map A-7 shows the distribution of prime farmland within the Basin.

Prime farmland is land best suited for producing food, feed, fiber, forage, and oilseed crops, and also land that is available for these uses. The land could be cropland, pastureland, rangeland, forest land, or other land but not urban and built-up land or water. It has the soil quality, growing season and moisture supply needed to produce sustained high yields of crops economically when treated and managed, including water management, according to modern farming methods.

Prime Forest Land - The supply and quality of the timber resource depends on the productiveness of the site. Forest cover must be permitted to remain on the most productive sites for the entire 20 to 100 years needed to produce the desired forest products demanded in the future. Such sites include the better pine sites of the Coastal Plain and the fertile soils of the riverbottoms and flood plains capable of producing quality hardwoods. If timber production is confined to poor sites with correspondingly poor soils capable of growing only trees of inferior quality at a slow rate, forest production will fall far below acceptable levels.

To assure the best use of the most productive forest land the USDA Secretary has suggested the concept of prime forest land. Prime forest land is defined as land having soils capable of producing 85 cubic feet or more of wood per acre per year when fully stocked with desirable stands and managed to protect water quality and maintain soil productivity. The land currently could be in cropland, pastureland, rangeland, forest land or other land but not in urban built-up land or water.

#### WATER RESOURCES

The availability of water is dependent on climate, terrain, vegetation and geology. These factors determine the amount of precipitation, infiltration and evapotranspiration. It has been estimated that two-thirds of the precipitation falling in North Carolina is lost due to evapotranspiration, and the remaining one-third becomes surface water or ground water (NC Department of Natural Resources and Community Development, 1977).

Surface Water - The surface waters of the Basin consist of natural lakes, reservoirs and streams with a combined area of 1,606,000 acres. The natural lakes are entirely in the Coastal Plain, of which Lake Mattamuskeet is the largest (67 square miles). The principle man-made



lakes in the Piedmont are Lake Michie and Lake Wheeler, which have a surface area of 550 acres and 575 acres respectively. The man-made impoundments are constructed to provide water for (1) water supply storage for cities and industries when natural flows are inadequate, (2) protection from flooding, and (3) recreation.

Ground Water - Quantities of ground water are adequate for most domestic and small industrial users and public supply needs in the Basin. Aquifers of the Coastal Plain generally provide greater quantities of ground water than those of the Piedmont.

Use and Management - United States Department of Agriculture agencies have major administrative responsibilities for programs to develop and manage water and related land resource conservation. These agencies include Soil Conservation Service, Forest Service, Agricultural Stabilization and Conservation Service and Farmers Home Administration. Educational and planning assistance is provided by the Economics, Statistics and Cooperatives Service and the Extension Service.

Soil Conservation Service provides assistance to land owners, operators, and other land users in planning, applying and maintaining water and land resource conservation program measures under authority of Public Law 46 of the 74th Congress, as amended. Assistance is provided to cooperating land owners or operators through local conservation district programs.

#### ECONOMIC RESOURCES

Population - The population of the Tar-Neuse study area grew 36 percent between 1940 and 1970 and is expected to increase at a rate less than half that in the next 30 years. Population grew at roughly the same rate as North Carolina from 1940 to 1960. Both North Carolina and the study area gained population at a rate less than that of the nation between 1940 and 1970.

Multi-county Planning Region J, located at the headwaters of the Tar-Neuse study area, has been the site of rapid industrialization and urbanization in the post World War II period. This area experienced a burst of population growth in the 1940's and again in the 1960's growing at a faster rate than North Carolina or the United States. The headwaters region is expected to grow at a more moderate pace in the future, a rate slightly above that of the state and the nation, and will increase its share of Basin population to 38 percent by 2020.

Planning Regions K, L, P, Q, and the hydrologic residual (the remaining drainage area outside Planning Regions K, L, P, Q) make up the Coastal Plain portion of the study area (Map A-8). This rural, agriculturally-oriented region experienced declining population growth from 1940 to 1970, shrinking from 74 percent of the Basin's population in 1940 to 66 percent in 1970. The Coastal Plain area is projected to continue slow population growth with only a slight increase in the rate of growth. The Coastal Plain's share of Basin population is expected to shrink to 62 percent by 2020.

The Tar-Neuse study area experienced net out-migration of roughly 10 percent of the population in the 1950's, slowing to 6 percent of the population in the 1960's. Economic development, as well as a national trend reversing the traditional south-to-north migration patterns, should mitigate this retarding factor in basin population growth.

Employment, Labor Force, and Income - Unemployment rose steadily from 1950 to 1970, but the rate of growth of unemployment has been markedly less in the later period. The unemployment rate in the Tar-Neuse study area was lower than that of the United States for 1950 and 1960, but was substantially above that for the United States in 1970. The military component of the work force has risen steadily from 1950 to 1970, but recent growth is off sharply down to 2.5 percent per year from the 11.6 percent per year recorded between 1950 and 1960.

The Basin's labor force grew slower than its population from 1950 to 1960, but faster than population between 1960 and 1970, following the same pattern as employment (see Table A-1). The labor force participation rate rose between 1950 and 1960, reflecting the strain on local markets created by new jobs, then dropped somewhat as a higher level of economic activity stabilized.

TABLE A-1  
EMPLOYMENT AND LABOR FORCE  
TAR-NEUSE RIVER BASIN STUDY AREA  
1950 - 1970

	1950	1960	1970
Population	1,371,103	1,522,174	1,637,977
Armed Forces	19,645	42,417	52,690
Civilian Labor Force	484,217	515,768	571,720
Participation Rate	59.5%	61.8%	60.0%
US Participation Rate	58.3%	59.2%	60.3%
Employment	465,819	489,059	540,760
Unemployed	18,398	26,709	30,960
Unemployment Rate	3.8%	5.2%	5.4%
US Unemployment Rate	5.3%	5.5%	4.9%

SOURCE: US Census of Population; adopted from Ashby.

Families in the Tar-Neuse experienced faster growth in income than the rest of the state and nation between 1959 and 1969, with incomes rising almost twice as fast as national family income (see Table A-2). Incomes in the more industrialized headwaters region of the Tar-Neuse study area are higher than the rest of the study area. Family incomes in the Coastal Plain region have consistently been lower than state incomes or incomes in the rest of the Basin. However, the rate of increase in family income in the Coastal Plain region between 1959 and 1969 was greater than that of the headwaters region or the rest of the state, indicating that at least some equalization of incomes may be occurring.

Of all families in the Tar-Neuse River Basin in 1969, 20 percent had incomes less than the official poverty level. This figure is greater than the 16 percent of families in North Carolina below poverty level and the 11 percent of the nation's families below the poverty level.

TABLE A-2  
FAMILY INCOME  
TAR-NEUSE RIVER BASIN STUDY AREA  
1949 - 1969

Region	1949	1959	1969
Headwaters <sup>1/</sup>	\$ 3,395	\$ 4,978	\$ 7,807
Coastal Plain <sup>2/</sup>	2,421	3,474	5,957
Tar-Neuse Study Area	2,703	3,930	6,546
North Carolina	2,999	4,532	7,080
United States	4,304	6,483	8,734

<sup>1/</sup> Multi-County Planning Region J

<sup>2/</sup> Multi-County Planning Regions K, L, P, and Q, and the hydrologic residual figure is the arithmetic average of family income for each region

SOURCE: US Census of Population

Per capita income is widely used as an indicator of well being. The study area ranks below the state and nation by this indicator. In 1970 per capita income by county ranged from \$1,502 in Hyde County to \$3,001 in Wake County. The median per capita income was \$2,045 in Beaufort County. These figures compare with the North Carolina average of \$2,474, which ranked 41st among states, and the US average of \$4,119.



Urban Centers and Influence - There were 11 centers of population having more than 10,000 persons within the Tar-Neuse study area in 1970 (Table A-3 and Map A-9). These population centers contain approximately 441,000 people, or 35 percent of the total population of the study area. The two largest major urban centers, Raleigh (106,753), and Durham (100,630), are located in the headwaters region of the study area. The concentration of population, urbanization and industrialization in the headwaters region is of significance for resource planning since problems of congestion, sprawl, water supply and pollution will be intensified in this region.

Urban centers in the Coastal Plain region of the Tar-Neuse study area in 1970 ranged from 12,029 to 34,549 persons, and with the exception of Camp LeJeune and Cherry Point, which are dominated by the military establishment, can be characterized as farm market centers. The Tar-Neuse study area has been urbanizing at an increasing rate between 1950 and 1970, with the increase in urban population equaling 8.6 percent in 1970 versus 5.4 percent for the state of North Carolina and 3.6 percent for the United States.

TABLE A-3  
MAJOR CENTERS OF POPULATION  
TAR-NEUSE RIVER BASIN STUDY AREA  
1970

Location		Population
<u>County</u>	<u>Center</u>	<u>100,000 - 109,999</u>
Wake	Raleigh	106,753
Durham	Durham	100,630
		<u>50,000 - 99,999</u>
		None
		<u>25,000 - 49,999</u>
Onslow	Camp LeJeune	34,549
Nash-Edgecombe	Rocky Mount	34,284
Wilson	Wilson	29,347
Pitt	Greenville	29,063
Wayne	Goldsboro	26,810
		<u>10,000 - 24,999</u>
Lenoir	Kinston	23,020
Onslow	Jacksonville	16,286
Craven	New Bern	14,660
Vance	Henderson	13,896
Craven	Cherry Point	12,029
TOTAL		441,327

SOURCE: US Census of Population

## Agriculture and Related Economic Activity

1. Number and Size of Farms - The number of farms in the study area declined by 48,687 farms, down 57 percent between 1954 and 1969 (Table A-4). The number of farms in the study area accounted for 30 percent of all farms in the state in 1954. This proportion has remained fairly constant.

TABLE A-4 - FARM NUMBERS, AVERAGE FARM SIZE, PERCENT OF LAND IN FARMS<sup>1/</sup>  
BY COUNTY, SELECTED YEARS 1954 - 1969

### TAR-NEUSE RIVER BASIN STUDY AREA NORTH CAROLINA

	: 1954	1959	1964	1969
<u>NORTH CAROLINA</u>				
Farm Numbers	267,906	190,567	148,202	119,386
Average Farm Size (acres)	68	83	97	107
Percent Of Land In Farms	58	51	46	41
<u>TAR-NEUSE STUDY AREA</u>				
Farm Numbers	84,759	60,974	46,299	36,072 <sup>2/</sup>
Average Farm Size (acres)	66	84	102	118
Percent Of Land In Farms	58	54	51	46

<sup>1/</sup> Land in farms ÷ approximate county land area.

<sup>2/</sup> The range is 84 acres in Johnston County to 270 acres in Hyde County in the study area.

SOURCE: US Bureau of Census, Census of Agriculture

Although the average farm in the study area is increasing in size, the historically small farm nature of the region remains. Farms with 50 acres or less comprise 42 percent of all farms in the River Basin. The small farm characteristics of the region are closely associated with the production of tobacco. Mechanization of tobacco harvesting has been slower than for other crops; however, more recently bulk dryers and harvesters have been improved and accepted. As a result, the substitution of capital for labor has lagged significantly behind that of other crops.

Approximately 50 percent of all farm operators in 1969 were classified as full owners, as compared to 31 percent in 1954. The proportion of part owners as a tenure-type for all farm operators doubled from 12 to 24 percent from 1954 to 1964. A leveling off occurred at 24 percent in 1969.

Since the Agricultural Census of 1969, corporate farms have become prominent in the coastal portions of the study area. Large scale operations are clearing and drainage normally wet lands for cultivating and grazing.

2. Agricultural Production - Crop production in the Tar-Neuse River Basin occurs on about one-half of the land in farms and this proportion has remained fairly stable since 1954. Farmers have continued to use a third of their land in crop production while shifting the use of the remaining land in farms. The portion of farms in woodland is less now and the land in soil improvement, idle land, house lots, etc., was more in 1969 than in 1954.

Crops: The acres of crops harvested declined 27 percent as the total land in farms dropped 24 percent during the years between 1954 and 1969. Most of the grain crops show a decline in acres harvested. Noticeable exceptions of crop declines are soybeans, and wheat, however, higher prices after 1970 led to increased crop production.

The three most important crops produced in the Tar-Neuse River Basin in terms of value of sales in 1969 were tobacco, corn and soybeans.

#### Livestock:

Livestock production has not been particularly important historically with the possible exception of hog production. More recently, however, poultry enterprise has developed relatively more than in the past. The following reasons appear to explain the livestock character of the Basin.

Swine production is and has been readily adaptable to small farm operations. The feed inputs of a hog enterprise are widely adapted to the soils and climate of the region. Production of corn, the most extensively used hog feed, is distributed over much of the study area.

Such feed grains as corn and sorghum can be easily grown and efficiently harvested on small as well as large farms. More recently, technical advances in animal nutrition have encouraged modern swine producers to depend on finely formulated feeds, partially or wholly substituting for home-grown feed grains.

The continuation of swine production, increasing poultry production, and a decline in dairy operations with extensive cash cropping indicates adjustments in agriculture to changes in relative prices and a continued effort on the part of farmers to achieve a satisfactory living.

Forest Resources - There is about 4.2 million acres of forests in the Basin.



More than 99 percent of the Basin's forests are classed as commercial (4,231,102 acres). Of the remainder, 13,270 acres are unproductive (incapable of producing 20 cubic feet per acre of industrial wood) and 7,192 acres are classed as productive reserve (withdrawn from timber use through statute or administrative designation). The Basin's commercial forest land makes up 22 percent of the total forest land in the state. Four percent of the Basin's forest land was diverted to other uses between 1964 and 1974. In the Piedmont and South-Coastal Plain portions, over half the lost acreage went to urban development. In the north coastal section over half the loss was to agriculture, primarily cropland. Forest specialists indicate that the above rates of loss may continue for the next 30 years.

Inventory: The standing volume inventory of growing stock in the Tar-Neuse Basin forest totals 5.5 billion cubic feet (see Table A-5). Sixty percent of this volume is sawtimber size, 42 percent of which is hardwood. About half the sawtimber is 16 inches or more in diameter at breast height and thus qualifies as "large sawtimber".

Besides the growing stock volume other possible future sources of wood include:

- (1) 538 million cubic feet in rough, rotten salvageable trees. About half of this volume is sawtimber.
- (2) 37 million cubic feet of timber killed annually by weather, suppression, insects, disease, fire and animals.

TABLE A-5 GROWING STOCK VOLUMES COMMERCIAL FORESTLAND

TAR-NEUSE RIVER BASIN -- 1974

Stand Size	Sawtimber Volume <sup>1/</sup>			Growing Stock Volume		
	--- Thousand Board Feet---			---Thousand Cubic Feet---		
	Pine	Hardwood	Total	Pine	Hardwood	Total
Sawtimber	10,303,989	7,505,808	17,806,797	1,927,815	1,373,368	3,301,183
Poletimber <sup>2/</sup>	-	-	-	901,773	1,293,355	2,195,128
TOTALS	10,303,989	7,505,808	17,806,797	2,829,588	2,666,723	5,496,311

<sup>1/</sup> Sawtimber volume is part of the total growing stock volume. A board foot is a piece of wood 12" long by 12" wide by 1" thick.

<sup>2/</sup> Poletimber is usually measured in cubic feet.

## RECREATION RESOURCES

The North Carolina Water Resources Framework Study (1977) discloses that visitors spend more than \$1 billion each year in the state, much of which is for enjoyment of North Carolina's outdoor recreation resources. An abundant outdoor recreation base exists in the Tar-Neuse Basin; however, facilities to provide maximum utilization are unavailable for current demands. The North Carolina Statewide Comprehensive Outdoor Recreation Plan (SCORP) data indicate there is need for over 300,000 additional acres of land and water for recreation.

## BIOLOGICAL RESOURCES

Wildlife Resources - There are two major natural regions in the Tar-Neuse study area, the Piedmont and the Coastal Plain. The boundary between these regions is the Fall Zone, or as it is more commonly called, the "Fall Line". Rivers and streams passing into the Coastal Plain are characterized by shoals and rapids in and near the Fall Line. In terms of game habitat, the boundary should be thought of as a broad transition zone, running along a line from the Town of Roanoke Rapids in Halifax County to the Wake-Johnston County line.

The Coastal Plain habitat consists of low lying, flat terrain covered with extensive swamp, pocosin, and marsh areas. Flood plains of the streams provide bottomland hardwood habitat. These wetland areas support excellent wildlife habitat. Nearly two-thirds of the region is forested with the following types predominant: loblolly pine-hardwood (most extensive), pond pine-pocosin, pocosin-shrub bog, and bottomland and swamp hardwoods. Savannah, longleaf pine-hardwood, and tidal marsh cover types are also found in the basin, but are of less value to wildlife. Extensive croplands in the Coastal Plain portion of the Basin also provide good habitat for the farm game species such as quail, dove and rabbit.

The major forest game species are deer, bear, squirrel and wild turkey. Pocosins and swamps are the most important for big game species (see Maps A-10, A-11, and A-12, Big Game Distribution Maps). Important waterfowl wintering ground include Pamlico, Core and Bogue Sounds with adjacent bays and marshes; Lake Mattamuskeet, Phelps Lake and Great Lake; and the river bottomlands and swamp hardwood areas.

The Piedmont portion of the Tar-Neuse area is typically hilly, with seasonally flooded bottomlands along the major streams. Predominant forest types are loblolly pine-hardwoods, shortleaf pine-hardwoods, Virginia pine-hardwoods, mountain hardwoods, and seasonally flooded bottomland hardwoods.

Quail, dove and small game animals are the most important wildlife species found in this region. The abundance of small grains grown is one of the major reasons for good concentrations of dove. Fair wild turkey populations still exist where suitable habitat remains. Deer, concentrated in the Camp Butner section, have spread into several adjoining counties. Waterfowl use in the Piedmont has increased with the creation of many large reservoirs and small farm ponds but does not approach that found in the Coastal Plain.

Wetland Habitat - Much of the valuable wildlife habitat in the Tar-Neuse area is wetland habitat. These lands are valuable because they produce substantial quantities of mast and provide a reliable source of food during periods of drought for both upland and bottom land species.

The major migratory bird population of the Basin is located in the coastal counties with the heavier concentrations in the northern coastal portion. Important wintering grounds include Pamlico, Core, and Bogue Sounds and their adjacent bays and marshes. The large acreages of river bottomlands and swamp hardwoods are also of primary importance.

There are five wildlife refuges in the Basin that are managed by the Fish and Wildlife Service. These refuges are the Pea Island, Lake Mattamuskeet, Swan Quarter, Ada Island and Pungo. There are also several management areas that are administered by the NC Wildlife Resources Commission including Gull Rock, Goose Creek and Croatan.

Fishing Streams - There are approximately 3,000 miles of fishing streams in the Tar-Neuse study area, or about 20 percent of the state's total. The streams in the Coastal Plain are generally of higher productivity than those in the Piedmont; therefore, if the streams were ranked in relation to fishing importance, the Tar-Neuse area (with its large number of Coastal Plain streams) should rank much higher in importance than indicated by the 20 percent of the state's fishing stream mileage.

Nine ecological classes of fishing streams are represented. Many species of fish other than those referred to in the class title are found in a given type of stream. For example, a largemouth stream is likely to support suckers, bullheads, and various sunfishes in addition to largemouth bass.

Flat Water Fishery - There are over 65,000 acres of natural lakes and impoundments in the Tar-Neuse Study Area. This figure doesn't include farm ponds and many smaller lakes that may have been overlooked. Thirty of these water bodies are 100 acres or larger in size, ranging up to Lake Mattamuskeet with its 42,000 acres. There are approximately 66,000 ponds (including irrigation pits and storage reservoirs) in the state, with about 21,000 of these in the counties of the Tar-Neuse area. Of this number, probably two-thirds could be considered suitable as fish ponds with an average size of about four acres.



## AREAS OF NATURAL BEAUTY

Natural Areas and Scenic Streams - Open space and environmental corridors are areas within or adjacent to urban centers that may be used for human enjoyment or recreation. Included are wetlands, estuaries, water-land interfaces and urban spaces. As urban centers expand, many of those areas are potentially eliminated by roads, utilities, commercial facilities and residences. Additional areas should be protected through restricted use so that the quality of existing areas will not be diminished by overuse.

Recreational demands of an increasing population are intensifying, and the opportunity of preserving the natural and scenic beauty of many streams has passed. The need for sustaining these values on remaining streams is recognized by state and federal governments through established criteria for classification and protection. Included are those rivers or sections of rivers that are free of impoundments, with watersheds still mostly primitive and shorelines largely underdeveloped (see Map A-13).

## CULTURAL RESOURCES

Archaeological, Architectural and Historic - More than 2,000 eighteenth, nineteenth, and early twentieth century structures of historic significance are widely scattered throughout the Tar-Neuse region. Of these, over 200 structures and historic districts are listed in the National Register of Historic Places. The Register provides a degree of protection for a historic property or archaeological site, but it does not guarantee its preservation. Local zoning to protect historic districts and the concern and efforts of a community, whether urban or rural, are important to the revitalization and protection and continued use of a community's heritage.

## ELEMENTS INCLUDED IN ED AND EQ

Table A-6 "Elements included in PL-566 Economic Development Alternative" for Tar-Neuse River Basin details the watersheds included in the long-range ED alternative. The proposed early action ED alternative consist of eleven of these PL-566 watersheds as detailed in Table A-7, and project measures from three resource conservation and development areas.

Table A-8 is a listing of proposed RC&D project measures for the ED Alternative.

Seven PL-566 watersheds as detailed and subtotaled in Table A-7 are included in the EQ alternative. Three resource conservation and development areas will contribute to the EQ plan through the RC&D program. Though limited to Orange County, the North Central Piedmont RC&D area will provide three project measures in the EQ plan. Planned measures in the Albemarle RC&D area include erosion control and critical area treatment. The Mid-East, with most of its own in the Basin, has numerous projects included in the EQ plan. A listing of proposed RC&D project measures for EQ is found in Table A-9.

TABLE A-6  
TAR-NEUSE RIVER BASIN, N. C.  
TABULATION OF ELEMENTS INCLUDED IN ECONOMIC  
DEVELOPMENT ALTERNATIVE 2020 -- PL-566 PROJECTS

FLOOD PREVENTION ONLY								FLOOD PREVENTION & IMPROVED DRAINAGE		
CNI Watershed Number	Watershed Area (ac)	Reservoir (no.)	Agri. Area Benefited (1,000 Ac)	Agri. Area Benefited (1,000 Ac)	Recreation (Acres)	Land Treated During Project Installation (1,000 Ac)	Installation Cost(\$1,000)			
03020101-10	108,728	8	16	0	56	18	7,660			
-20	43,800	1	5	0	0	7	1,302			
-30	67,473	6	3	0	50	14	4,705			
03020102-20	94,330	6	10	0	172	11	5,172			
03020101-100	72,656	1 1/	4	0	200	15	5,655 1/			
03020201-10	117,969	6 1/	5	0	400	15	7,109 1/			
-30	98,564	4 1/	2	0	300	11	4,986 1/			
-190	128,875	1 1/	19	0	0	31	4,544 1/			
03020203-60	61,646	2 1/	0	15	35	15	2,588 1/			
03020201-120	90,131	4 1/	14	0	125	15	5,967 1/			
-130	77,465	1 1/	13	0	0	18	3,060 1/			
-150	100,667	0	0	37	0	24	2,236			
03020102-50	159,163	0	0	64	160	31	15,984			
-70	71,650	0	0	39	95	14	7,279			
03020103-10	39,422	0	0	20	50	10	4,658			
-20	37,838	0	0	1	0	9	4,269			
-30	95,099	0	0	47	110	24	11,518			
03020105-60	37,825	0	0	21	50	9	4,303			
03020103-60	46,255	0	0	26	35	11	5,166			
03020104-10	44,050	0	0	18	40	7	3,922			
03020105-20	20,193	0	0	18	40	2	1,448			
-30	11,440	0	0	11	10	1	826			
-40	38,560	0	0	25	60	4	2,878			
-70	10,000	0	0	9	0	1	691			
03020203-40	78,943	0	0	43	100	20	9,431			
-13	79,517	0	0	47	24	21	9,452			
03020201-140	47,827	0	0	35	0	12	5,390			
-200	51,377	0	0	33	80	13	6,106			
03020202-10	19,611	0	0	9	0	5	2,221			

1/ Includes municipal and industrial water storage.

TABLE A-6

## TAR-NEUSE RIVER BASIN, N. C.

TABULATION OF ELEMENTS INCLUDED IN ECONOMIC  
DEVELOPMENT ALTERNATIVE 2020 -- PL-566 PROJECTS

-2-

FLOOD PREVENTION ONLY										FLOOD PREVENTION & IMPROVED DRAINAGE			
CNI Watershed Number	Watershed Area (ac)	Reservoir (no.)	Agri. Area Benefited (1,000 Ac)	Agri. Area Benefited (1,000 Ac)	Recreation (Acres)	Land Treated During : Project Installation: (1,000 Ac)	Installation : Cost(\$1,000)						
03020202-10	20,830	0	0	10	0	5	2,358						
-20	136,392	0	0	69	100	20	15,791						
-40	34,000	0	0	19	50	8	3,894						
-50	90,418	0	0	43	100	20	10,095						
-60	32,222	0	0	13	30	7	3,607						
-80	82,505	0	0	66	0	9	5,723						
-100	84,456	0	0	41	100	9	6,212						
03020204-10	243,300	0	0	0	0	29	-						
-20	114,097	0	0	289	200	11	31,511						
03020202-90	69,716	0	0	0	0	8	-						
03020204-30	96,312	0	0	58	140	9	6,769						
-40	10,000	0	0	6	45	1	792						
-60	8,000	0	0	6	45	1	666						
03030001-30	38,109	0	0	30	75	3	2,671						
03020106-10	98,300	0	0	77	190	9	6,996						
-20	90,468	0	0	52	125	6	5,487						
TOTAL	3,200,199	40	91	1,297	3,392	543	243,667						



TABLE A-7  
TAR-NEUSE RIVER BASIN, NORTH CAROLINA  
TABULATION OF ELEMENTS INCLUDED IN EARLY ACTION ECONOMIC DEVELOPMENT AND ENVIRONMENTAL QUALITY<sup>2/</sup>  
ALTERNATIVES 1990, -- PL-566 PROJECTS

CNI Watershed Number	Watershed Area (ac)	Reservoir: (no)	FLOOD PREVENTION ONLY		FLOOD PREVENTION & IMPROVED DRAINAGE		Recreation: (acres)	Land Treated During Project Installation: (1,000 ac)	Installation Cost (\$1,000)
			Agricultural Area Benefited (1,000 acres)	Agricultural Area Benefited (1,000 acres)	Agricultural Area Benefited (1,000 acres)	Agricultural Area Benefited (1,000 acres)			
03020101-10	108,728	8	16		0		56	18	7,660
-20	43,800	1	5		0		0	7	1,302
-30	67,473	6	3		0		50	14	4,705
03020201-10	117,969	6	5		0		400	15	7,109
-20	64,000	0	0		0		0	6	472
-30	98,564	4	2		0		300	11	4,986
-40	129,303	3	16		0		0	13	4,295
SUBTOTAL	629,837	28	47		0		806	84	30,529
03020105-30	11,440	0	0		11		10	1	2,878
03020201-170	136,392	0	0		69		100	20	15,791
03020105-10	10,440	0	0		7		0	0	1,200
TOTAL	288,109	28	47		87		916	105	50,398

1/ Land treatment only watershed.

2/ EQ elements listed in first seven watersheds of Table.

TABLE A-8  
PROPOSED RC&D PROJECT MEASURES FOR ED<sup>1</sup>/  
TAR-NEUSE RIVER BASIN, NORTH CAROLINA

<u>RC&amp;D AREA</u>	<u>PROJECT MEASURE</u>	
<u>Mid-East</u>	<u>County</u>	<u>Description</u>
	Areawide	Improve agricultural water management program.
	Areawide	Obtain adequate cost sharing and technical assistance for soil and water conservation practices.
	Beaufort	Provide educational program on shore erosion.
	Areawide	Develop program to more effectively control wind erosion.
	Martin	Provide flood control and drainage, Beargrass Watershed.
	Martin	Provide flood control and drainage, Flat Swamp Watershed.
	Pitt	Conduct current groundwater inventory.
	Pitt	Conduct long range water needs study.
	Pitt	Prepare kit of literature for prospective homeowners.
	Areawide	Study the feasibility of gaining economic returns from the sale of hunting rights.
	Pitt	Cooperative groundwater pollution study.
	Beaufort	Improve Belhaven waterfront.
	Beaufort	Soil survey for Belhaven.
	Beaufort	Obtain city of Washington soil survey.
	Beaufort	Shore erosion control Teach's Point.
	Pitt	Expand water and sewer system.
	Beaufort	Expand Aurora water system.
	Beaufort	Pantego water system.
	Pitt	Grifton Park.
	Pitt	Formulate flood control project for Grifton.
	Beaufort	Formulate flood control project for Belhaven.
	Beaufort	Employ regional soil scientist.
	Martin	
	Pitt	Provide critical area treatment on school grounds.

TABLE A-8  
(Continued)

<u>RC&amp;D AREA</u>		<u>PROJECT MEASURE</u>
<u>Mid-East</u>	<u>County</u>	<u>Description</u>
	Pitt	Provide flood control and drainage, Simpson.
	Beaufort	Amphitheater critical area treatment.
	Beaufort	Haven's Gardens, public water-based recreation.
	Pitt	Town of Falkland drainage.
	Beaufort	Drainage and critical area treatment, schools.
	Beaufort	Resource Conservation Planning Course, schools.
	Beaufort	Washington Park, Flood Prevention and Drainage.
	Pitt	Grimesland School, Drainage and Critical Area Treatment.
North Central Piedmont	Orange	M&I water supply on Seven Mile Creek.

1/ Provide by RC&D Project Coordinators.



TABLE A-9  
PROPOSED RC&D PROJECT MEASURES FOR EQ<sub>1</sub>/  
TAR-NEUSE RIVER BASIN, NORTH CAROLINA<sup>1/</sup>

<u>RC&amp;D AREA</u>		<u>PROJECT MEASURE</u>
<u>Mid-East</u>	<u>County</u>	<u>Description</u>
North Central Piedmont		Sediment control and flood protection on Seven Mile Creek.
		Water Trail on Eno River.
		Sediment control and flood protection on McGowen Creek.
Albermarle		Erosion and sediment control and roadside critical area treatment in Dare, Hyde, and Washington Counties.
Mid-East	Beaufort	Provide critical area treatment along roads.
	Martin	Provide critical area treatment along roads.
	Pitt	Provide critical area treatment along roads.
	Beaufort	Increase shore erosion control.
	Pitt	Provide national environmental demonstration project for Chicod Creek.
	Beaufort	Provide a historic Bath amphitheatre.
	Pitt	Water-based recreation areas.
	Areawide	Establish at least 1 outdoor classroom.
	Areawide	Seed power line rights-of-ways for upland game.
	Areawide	Establish managed public hunting areas for upland game.
	Beaufort	Develop bear habitat management program.
	Martin	
	Areawide	Increase number of waterfowl habitat areas.

<sup>1/</sup> Provided by RC&D Project Coordinators.

## GLOSSARY

Best Management Practices - "a practice", or combination of practices that is the most effective, practicable means of preventing or reducing the amount of pollution generated by non-point sources to a level compatible with water quality goals.

Component - is a desired plan out-put.

Component Need - is a desired plan out-put that has been determined and quantified through public participation.

Conservation Needs Inventory - is an inventory of potential farm land performed in 1967 to assess the needs for various soil conservation practices. The results of this inventory were published in Conservation Needs Inventory.

Inseparable flooding and drainage - occurs in flat nearly level area from direct precipitation that cannot drain off of the land onto which it fell, thus making it impossible to differentiate from flood damage or from inadequate drainage damage.

KG Blade - an angled blade, mounted on the front of a bulldozer, used to shear trees and brush at or below ground level.

Land treatment measures - practices developed to stabilize soil, conserve and/or protect water quality, prevent fires, improve farming efficiency, enhance fish and wildlife. Examples are terraces, field borders, ponds, tree plantings, waste treatment lagoons, tile drains, etc.

Level B Study - is a river basin study which uses only existing data from which to make plans with no new data generated.

Pocosin - is an evergreen shrub log.

Prime waterfowl habitat - those areas in the state which provide the most abundant supply and variety of suitable food and cover for resident, transient and wintering waterfowl. Usually associated with marshlands, shallow coastal sounds, outer banks, and timbered swamps and bottomlands.

Primeval Forests - those forest communities which originated prior to the advent of man and have been influenced by human activity; versus second growth forests that regenerated naturally after removal of the previous stand by cutting, fire, or other causes.

Regeneration - involves the restocking of an area with forest trees, either by artificial (i.e., tree planting or seeding) or natural means.

## GLOSSARY - Continued

Rill erosion - the removal of soil by the cutting of numerous small water channels by concentrated surface runoff.

Roller chopping - A site preparation method involving the use of cylindrical drums, mounted with sharp blades, pulled by bulldozers over logged areas to shear and chop brush and logging debris.

Saltwater management - the controlled saltwater - freshwater interface.

Sheet erosion - the more or less uniform removal of soil from the land surface by runoff water with the development of a conspicuous water channel.

Silvicultural practices - are those forestry practices applied to control the establishment, composition, constitution, and growth of forest.

Site preparation - includes measures aimed at preparing logged sites for the successful establishment of new tree growth, involving the use of fire, herbicides, and/or machinery to clear areas of logging debris and eliminate vegetation which may compete with new growth.

Specific Component - is a redefined component need to further refine specific plan output.

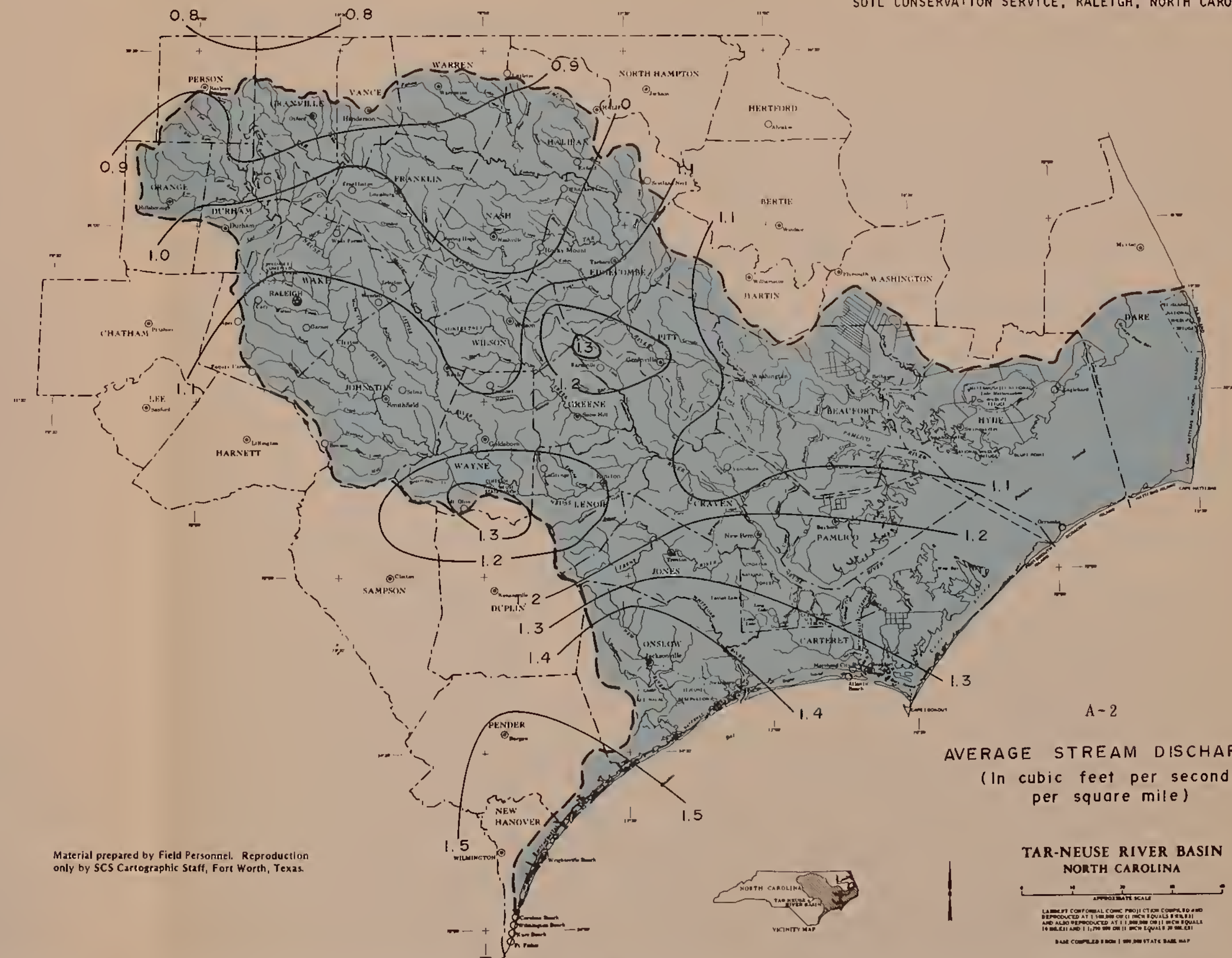
Wetlands - lands that are transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or land covered by shallow water. An area where water is the dominant factor that determines soil types, and plant and animal communities.











SOURCE: USGS Water Resources Investigations 46 - 74.







SOURCE: Weather And Climate In North Carolina  
Bulletin 396 Revised Oct. 71









## GENERAL SOIL MAP OF NORTH CAROLINA

COMPILED TO SCALE OF 1:1,000,000

## LEGEND OF SOIL ASSOCIATIONS, DESCRIPTIONS OF TOPOGRAPHY AND SELECTED INTERPRETATIONS

The soil associations have been named for two or three major soil series that enter or mapped areas. Less extensive soils are mentioned by name only. A general soil map does not show individual series occupied by mapped soil series since it is impractical on a map of this size. In the accompanying table, the kind of soil in each major series is evaluated for some of the more important uses. In this way, one may learn about the broader potentialities of the soils in each mapped area. Some of the considerations followed in developing the map are explained in the following paragraphs. In the topographic settings for each association are statements that describe the prevailing slopes or which the soils occur. The names of these terms and limits read are as follows:

Limit	Name
0-3 percent	Level
3-15 percent	Sloping
15-25 percent	Moderately steep
More than 25 percent	Steep

Also, the common names are given for the country towns which underlie the soil and presumably give rise to the parent material.

Interpretations of soil series named as major soils in associations are listed for depth to bedrock, shrink-swell potential, flooding; soil fertility for general agriculture as well as timber and pulpwood. Soil limitations for building, shallow excavations and septic tank filter fields are also included.

## Description

**Shrink-swell potential** is expressed as low, moderate or high. Soils with a low rating have little or no change in volume (shrinkage < 0.05) from wet to dry and are consequently not subject to cracking and with small amounts of slightly plastic clays. Soils with a moderate rating have moderate change in volume (shrinkage 0.05-0.06) from wet to dry, are mostly medium textured or moderately fine textured and with little or no highly plastic clays. Soils with a high rating have large changes in volume (shrinkage > 0.06) from wet to dry, are moderately fine or fine and contain significant amounts of highly plastic clays.

**Flood hazard** is rated as slight, moderate or severe. Slight is for soils of the uplands that are rarely if ever flooded. Moderate is for soils on low terraces and high flood plains where flooding may take place but is not common occurrence. Severe is for soil on lowlands, mostly alluvial plains, where flooding is a serious hazard unless provisions are made against it.

## Selected Interpretations

**Soil Suitability** - Suitability ratings of good, fair and poor are used for general agriculture which include the common rilled crops, pasture, tree fruits of the region and timber and pulpwood. They are based on the best known feasible management practices and are defined in the paragraphs that follow.

**Good** - These soils are among the best for the rated use considering response to known combinations of management practices. They have properties (including climate) that are favorable for high production of plants or animals or performance for this kind of use. High production or performance and low risks to use are common for these soils when ordinary good management is followed.

**Fair** - These soils can be used satisfactorily for the rated use but careful planning and management are required. Under good management and over a reasonable period of time crop yields can be expected to meet cost of production. Moderate restrictions in use and performance are common.

**Poor** - These soils do little or no work for the rated use for the rated use. The production of crops or the performance of these soils for the rated use is low with extremely known combinations of management practices. Adverse soil features that require specialized site preparation and management are of sufficient degree that serious loss of effort and expense are incurred and normally exclude these soils for the rated use. Some kinds of soil, through reclamation, may be improved to give a favorable benefit-cost ratio for selected uses.

**Soil Limitations** - Soil limitation ratings of slight, moderate and severe are given for uses for roadsides, shallow excavations and septic tank filter fields. Foundations are for houses with basements and other buildings with similar foundation requirements. Shallow excavations, to an average depth of 15 feet, pertain to the several uses that involve the excavation of earth as basements, trenches for pipelines or pits for roads. Ratings for all these uses are based on the hazards, risks or restrictions of a soil as it occurs in the landscape or as it is normally modified by the use itself. They are defined in the paragraphs that follow.

**Slight Limitations** - These kinds of soil have properties that are favorable for the rated use but careful planning and design are required to overcome specific soil limitations or special maintenance may be required. There may be situations where the soil limitations somewhat the performance of the structure or other planned use, although generally satisfactory, may be somewhat less desirable than for soils rated as having a slight soil limitation. Some soil with this rating may require special treatment in design such as soil drainage, runoff control or other treatment, extensive revegetation fields, extra excavation, or the modification of certain soil features through soil manipulation. Construction plans may need to be modified from their normally used to overcome soil limitations. This may include special foundations, extra reinforcement, sump pumps, and the like.

**Moderate Limitations** - These kinds of soil can be used satisfactorily for the rated use but careful planning and design are required to overcome specific soil limitations or special maintenance may be required. There may be situations where the soil limitations somewhat the performance of the structure or other planned use, although generally satisfactory, may be somewhat less desirable than for soils rated as having a slight soil limitation. Some soil with this rating may require special treatment in design such as soil drainage, runoff control or other treatment, extensive revegetation fields, extra excavation, or the modification of certain soil features through soil manipulation. Construction plans may need to be modified from their normally used to overcome soil limitations. This may include special foundations, extra reinforcement, sump pumps, and the like.

**Severe Limitations** - Normally these kinds of soil cannot be used for the rated use except at great cost or risk because they have one or more adverse features. Some kinds of soil having a severe soil rating can be changed by reducing or removing the soil feature that limits its use. In some instances drastic changes in building plans are required. This is true in the case of soils that are unsuitable to alter the soil or modify the applications for construction to this extent. Some kinds of soil rated as severe can be used satisfactorily for the intended use. Normally it is better to select a soil that is less expensive to develop than one rated as having severe soil limitations.

MAP SYMBOL	SOIL ASSOCIATION NAME	TOPOGRAPHIC SETTING	MINOR SOILS IN ASSOCIATION	SOIL SERIES	DESCRIPTION			SELECTED INTERPRETATIONS						
					DEPTH TO BEDROCK (Feet)	SHRINK-SWELL POTENTIAL	FLOODING	SUITABILITY FOR		LIMITATIONS FOR				
								GENERAL AGRICULTURE	TIMBER & PULPWOOD	DWELLING	EXCAVATIONS	SEPTIC TANK FILTER FIELDS		
SOUTHERN PIEDMONT				SOUTHERN PIEDMONT										
10	Wilkes-Helena	Moderately steep slowly permeable upland ridges and side slopes underlain by dark colored schist and some gabbro and diorite	Enon Varr	Appling	> 5	Moderate	Slight	Good	Good	Moderate	Moderate	Moderate	Moderate	Moderate
				Cecil	> 5	Moderate	Slight	Good	Good	Moderate	Moderate	Moderate	Moderate	Moderate
				Crookston	> 5	Moderate	Slight	Fair	Good	Severe	Severe	Severe	Severe	Severe
				Durham	> 5	Low	Slight	Good	Good	Slight	Slight	Slight	Slight	Slight
11	White Star-Crookston	Sloping slowly permeable slightly dissected uplands underlain by light-colored rocks	Mayodan Granville Pinkston	Enon	> 3	High	Slight	Fair	Good	Severe	Severe	Severe	Severe	Severe
				Georgetown	8-20	Low	Slight	Good	Good	Moderate	Moderate	Moderate	Moderate	Moderate
				Herndon	> 10	Low	Slight	Good	Good	Moderate	Moderate	Moderate	Moderate	Moderate
13	Cecil-Applying-Pocahontas	Sloping uplands underlain by gneiss, schist and slate	Georgeville Herndon	Lignum	3-6	Moderate	Slight	Fair	Good	Severe	Severe	Severe	Severe	Severe
				Louisburg	7-6	Low	Slight	Poor	Fair	Moderate	Moderate	Moderate	Moderate	Moderate
14	Appling-Durham-Vance	Sloping uplands underlain by gneiss, schist and clayey redizerte	Louisburg Cecil	Mayodan	> 5	Low	Slight	Good	Good	Moderate	Moderate	Moderate	Moderate	Moderate
				Wren	3 1/2-5	Low	Slight	Fair	Fair	Moderate	Moderate	Moderate	Moderate	Moderate
15	Georgetown-Herndon	Sloping uplands underlain by schist and some gabbro and diorite as "Carolina Slate"	Lignum Nason Tatum	Pocahontas	5-20	Low	Slight	Fair	Good	Moderate	Moderate	Moderate	Moderate	Moderate
				Tatum	3 1/2-5	Low	Slight	Fair	Fair	Moderate	Moderate	Moderate	Moderate	Moderate
16	Wedowee-Durham-Louisburg	Moderately steep uplands underlain by acid igneous and metamorphic rocks; mainly granite, gneiss, schist and some micaceous rocks	Appling	Vance	> 4	Moderate	Slight	Fair	Good	Moderate	Moderate	Moderate	Moderate	Moderate
				Wedowee	4-6	Low	Slight	Fair	Good	Moderate	Moderate	Moderate	Moderate	Moderate
20	Helena-Vance	Slowly permeable sloping uplands underlain by gabbro, schist and granite	Enon	White Star	> 4	High	Slight	Poor	Fair	Severe	Severe	Severe	Severe	Severe
25	Appling-Wedowee-Louisburg	Sloping to moderately steep uplands underlain by gneiss and schist	Cecil	Wilkes	> 3	Moderate	Slight	Poor	Fair	Severe	Severe	Severe	Severe	Severe

MAP SYMBOL	SOIL ASSOCIATION NAME	TOPOGRAPHIC SETTING	MINOR SOILS IN ASSOCIATION	SOIL SERIES	DESCRIPTION			SELECTED INTERPRETATIONS						
					DEPTH TO BEDROCK (Feet)	SHRINK-SWELL POTENTIAL	FLOODING	SUITABILITY FOR		LIMITATIONS FOR				
								GENERAL AGRICULTURE	TIMBER & PULPWOOD	DWELLING	EXCAVATIONS	SEPTIC TANK FILTER FIELDS		
SOUTHERN COASTAL PLAIN														
27	Lakeland-Norfolk-Wagram	Sloping uplands underlain by sandy and loamy sandstone	Troy, Bibb Potliss Goldsboro	Alterata	> 5	Low	Slight	Good	Good	Moderate	Moderate	Moderate	Moderate	Severe
29	Norfolk	Sloping uplands underlain by loamy and sandy sandstone	Goldsboro Lynchburg Rains	Goldsboro	> 10	Low	Slight	Good	Good	Moderate	Moderate	Moderate	Moderate	Severe
30	Norfolk-Lynchburg	Sloping uplands underlain by loamy and sandy sandstone	Wagram Rains Johnston	Johnston	> 10	Low	Severe	Poor	Fair	Severe	Severe	Severe	Severe	Severe
36	Goldsboro-Lynchburg	Somewhat wet gently sloping uplands underlain by loamy sandstone	Rains	Lakeland	> 10	Low	Slight	Poor	Poor	Moderate	Moderate	Moderate	Moderate	Severe
37	Norfolk-Goldsboro	Gently sloping uplands underlain by loamy and sandy sandstone	Rains Lynchburg Wagram	Lynchburg	> 10	Low	Slight	Good	Good	Severe	Severe	Severe	Severe	Severe
38	Roanoke-Wake-Wicham	Level wet uplands and terraces underlain by clayey and loamy sandstone	Wagram	Norfolk	> 10	Low	Slight	Good	Good	Slight	Slight	Slight	Slight	Severe
39	Wicham-Altrivata	Level uplands and terraces underlain by loamy sandstone	Roanoke	Partolus	> 10	Low	Slight	Poor	Fair	Severe	Severe	Severe	Severe	Severe
40	Partolus-Johnston	Level, sandy, partially wet	Bibb Rains	Rains	> 10	Low	Severe	Fair	Fair	Severe	Severe	Severe	Severe	Severe
ATLANTIC COAST FLATWOODS														
41	Pocahontas-Pamlico-Dorchester	Swamps and marshes	Terhune Johnston	Wagram	> 10	Low	Slight	Fair	Fair	Severe	Severe	Severe	Severe	Severe
42	Capron-Newhan	Marshes and associated dunes and beaches along coast		Rains	> 10	Low	Severe	Fair	Fair	Severe	Severe	Severe	Severe	Severe
43	Chilpey-Lynn Haver-Leon	Level wet uplands underlain mainly by medium sand	Johnston Rutledge Terhune	Roroka	> 10	Moderate	Moderate	Fair	Good	Severe	Severe	Severe	Severe	Severe
44	Wicham-Roanoke	Level swampy alluvial plains subject to overflow	Lumbre John	Wagram	> 10	Low	Slight	Fair	Fair	Slight	Slight	Slight	Slight	Severe
46	Lakeland-Kennanaville	Sloping coastal plain, dunes in part, underlain mainly by medium and coarse sands	Chilpey Partolus	Wahwee	> 10	Moderate	Moderate	Fair	Good	Severe	Severe	Severe	Severe	Severe
49	Wichamville-Paquotank	Level wet uplands of terraces underlain by silty sandstone or fluvial sandstone	Barclay Bladder	Wicham	> 6	Low	Moderate	Moderate	Good	Severe	Severe	Severe	Severe	Severe
50	Bladder-Rayburn	Low lying marine terraces of clayey sandstone	Leon Rains	Wicham	> 6	Low	Moderate	Moderate	Good	Severe	Severe	Severe	Severe	Severe
51	Bladder-Lenoir-Hyde	Level wet uplands and terraces underlain by clayey sandstone		Wicham	> 6	Low	Moderate	Moderate	Good	Severe	Severe	Severe	Severe	Severe
52	Leon-Lenoir-Croven	Level wet uplands and terraces underlain by clayey sandstone	Bladen Lumbre	Wicham	> 6	Low	Moderate	Moderate	Good	Severe	Severe	Severe	Severe	Severe
53	Bladen-Lenoir	Level wet uplands and terraces underlain by clayey sandstone	Croven	Wicham	> 6	Low	Moderate	Moderate	Good	Severe	Severe	Severe	Severe	Severe
56	Croven-Marlboro-Bladen	Somewhat wet level uplands and terraces underlain by clayey sandstone	Dunbar	Wicham	> 6	Low	Moderate	Moderate	Good	Severe	Severe	Severe	Severe	Severe
59	Gorville-Exum	Level somewhat wet uplands underlain by clayey and silty sandstone	Bladen	Wicham	> 6	Low	Moderate	Moderate	Good	Severe	Severe	Severe	Severe	Severe
60	Leon-Leaf	Level somewhat wet uplands and terraces underlain by clayey sandstone	Bladen	Wicham	> 6	Low	Moderate	Moderate	Good	Severe	Severe	Severe	Severe	Severe
61	Lynchburg-Dunbar-Rains	Level somewhat wet uplands and terraces underlain by clayey and loamy sandstone	Duplin Norfolk	Wicham	> 6	Low	Moderate	Moderate	Good	Severe	Severe	Severe	Severe	Severe
64	Hyde-Pocahontas-Rutledge	Level wet uplands and terraces underlain by loamy and clayey sandstone	Pocahontas Terhune	Wicham	> 6	Low	Moderate	Moderate	Good	Severe	Severe	Severe	Severe	Severe
66	Portsmouth-Woodington	Level wet uplands and terraces underlain by loamy sandstone	Stallings	Wicham	> 6	Low	Moderate	Moderate	Good	Severe	Severe	Severe	Severe	Severe



SOIL RESOURCE GROUPS OF THE TAR NEUSE RIVER BASIN

A Soil Resource Group (SRG) is a "group of land capability units having similar cropping patterns, yield characteristics, responses to fertilizer, and management and land treatment measures." a/

**SOUTHERN PIEDMONT:** A region of gently rolling to hilly slopes with narrow stream valleys. Elevation increases gradually from east to west. Local relief is mainly in tens of feet but ranges to several hundred feet. Most of the land is in farms though industrial plants are common. b/

SRG	Representative Soil (s) c/	Land Capability Class & Subclass c/	Main Management Problems c/
10-11	Leul	IIe, IIIe, IVe	Slope & Surface Runoff
12	Enon	IIe, IIIe, IVe	Slope & Surface Runoff
17	Wilkes	IVe, VIe, VIIe	Slope & Surface Runoff

**SOUTHERN COASTAL PLAIN:** A region of gently slopes with increased dissection and strong slopes on its westerly boundary. Local relief is in tens of feet. About half the area is forested with significant acreages of cash crops. b/

SRG	Representative Soil (s) c/	Land Capability Class & Subclass c/	Main Management Problems c/
18	Kalamia, Nixinton, Norfolk	I, IIe	Runoff
19	Norfolk	IIIe, IVe	Slope, Leaching & Surface Runoff
22	Lucy, Wagram	IIe	Droughtiness, Wind, erosion, and leaching
23	Dogue, Lenoir, Lynchburg	IIw	Wetness
24	Bibb	IVw	Flooding & Wetness
25	Pacelus	IIIw	Leaching & Wetness

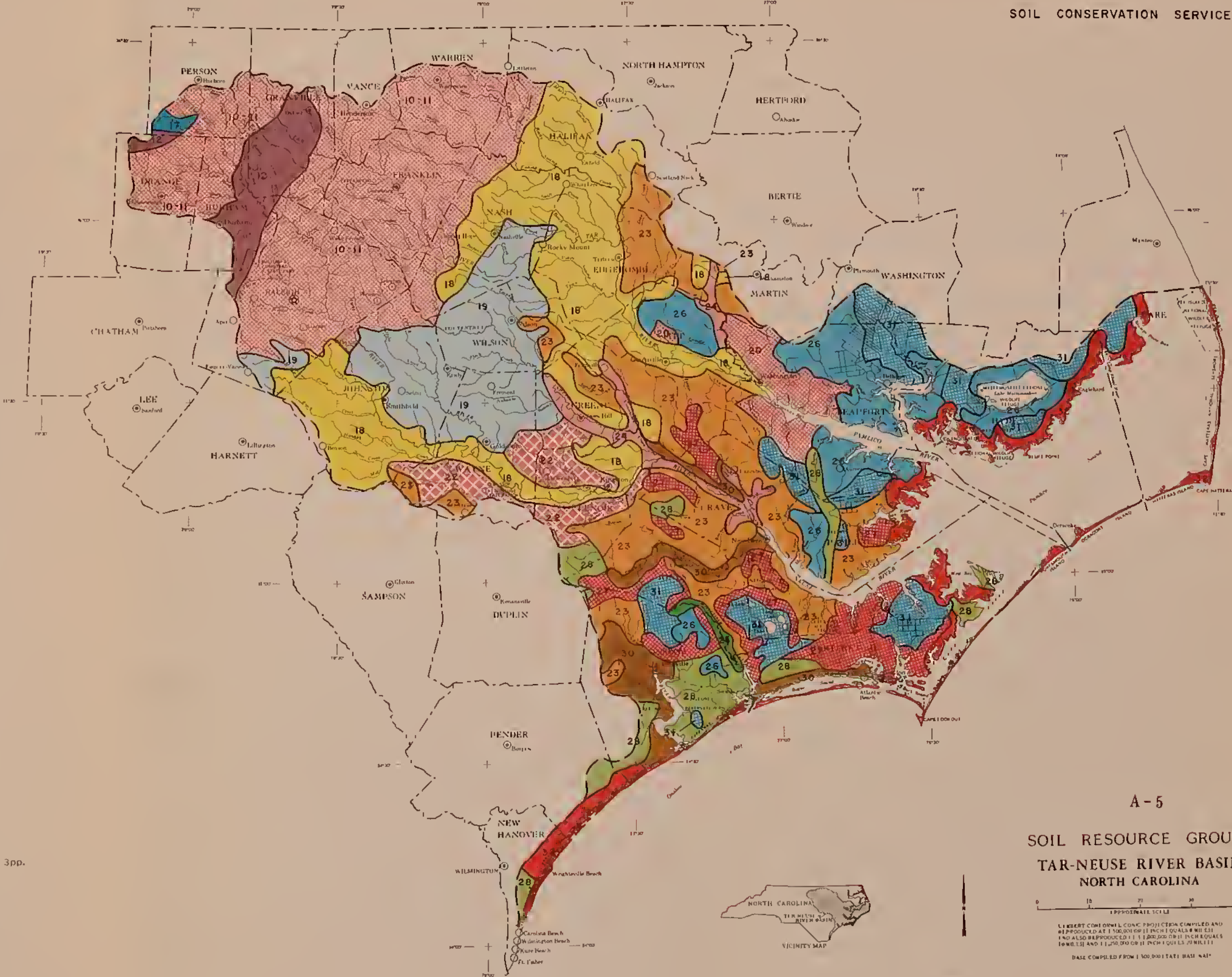
**ATLANTIC COAST FLATWOODS:** A region of nearly level coastal plain cut by broad valleys with meandering streams. Local relief is mainly a few feet to ten or twenty feet. Most of the land is in farms though shallow lakes, bogs, and swamps are extensive in some areas. b/

SRG	Representative Soil (s) c/	Land Capability Class & Subclass c/	Main Management Problems c/
26	Craven	IIe, IIIe	Slope, Wetness & Surface Runoff
23	Dogue, Lenoir, Lynchburg	IIw	Wetness
24	Bibb	IVw	Wetness
26	Rains	IIIw	Wetness
27	Cape Fear, Pantego, Portsmouth	IIIw	Wetness
28	Ruffedge	IIIw, IVw	Wetness and Leaching
30	Burcombe, Lakeland, Molena	IIIe, IVe	Leaching, Wind Erosion, & Droughtiness
31	Durrowan	Vw, VIIw	Wetness & Organic Materials
32	Capers	VIIe, VIIIs, VIIIw	Miscellaneous, including Tidal Marsh & Dunes

a/ Soil Conservation Service. 1971. River Basin Memorandum-30. USDA. Washington, D. C. 3pp.

b/ Soil Conservation Service. 1975. General Soil Map, 4-R-32018. USDA. Raleigh, N. C.

c/ Economic Research Service, Soil Conservation Service, and Forest Service. 1975. Soil Productivity Groups, North Carolina. USDA. Raleigh. 71pp., 2 Appendices.



SOIL RESOURCE GROUPS  
TAR-NEUSE RIVER BASIN  
NORTH CAROLINA

0 10 20 30 40  
MILES  
APPROXIMATE SCALE

LINBERT CONTINENTAL CONIC PROJECTION COMPILED AND  
REPRODUCED AT 1:500,000 (1:125,000 ON 11 INCH SQUARES AND 1:1  
AND ALSO REPRODUCED AT 1:1,000,000 (1:125,000 ON 11 INCH SQUARES  
AND 1:1,000,000 ON 11 INCH SQUARES 20 MILES)

BASE COMPILED FROM 1:500,000 TARI BASIN MAP



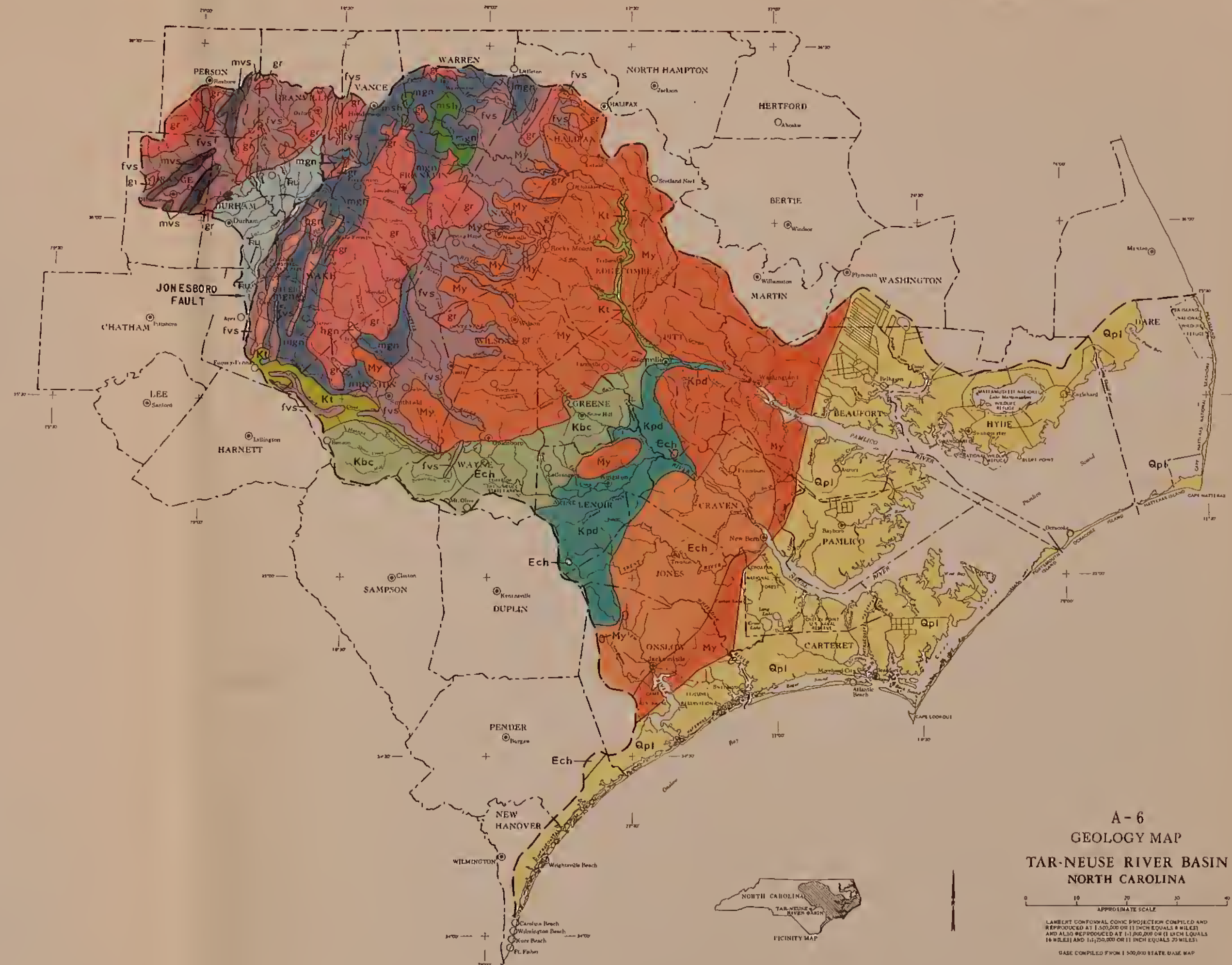


## SEDIMENTARY ROCKS

- ## METAVOLCANIC ROCKS

- IGNEOUS AND METAMORPHIC ROCKS

- g** GRANITE: Massive to weakly foliated, even-grained to porphyritic granitic rocks.
- hgn** HORNBLende GNEISS: Chiefly hornblende gneiss and schist with interbeds of mica gneiss and mica schist.
- mg** MICA GNEISS: Chiefly mica gneiss, includes mica schist and a wide variety of other gneiss and schists.
- ms** MICA SCHIST: Chiefly mica schist, includes mica gneiss and a wide variety of other gneisses and schists.



A - 6  
GEOLOGY MAP  
TAR-NEUSE RIVER BASIN  
NORTH CAROLINA

0 10 20 30 40  
APPROXIMATE SCALE

LAMBERT CONFORMAL CONIC PROJECTION COMPILED AND  
REPRODUCED AT 1:500,000 OR 11 INCH EQUALS 8 MILES  
AND ALSO REPRODUCED AT 1:1,000,000 OR 11 INCH EQUALS  
16 MILES AND 1:1,750,000 OR 11 INCH EQUALS 20 MILES

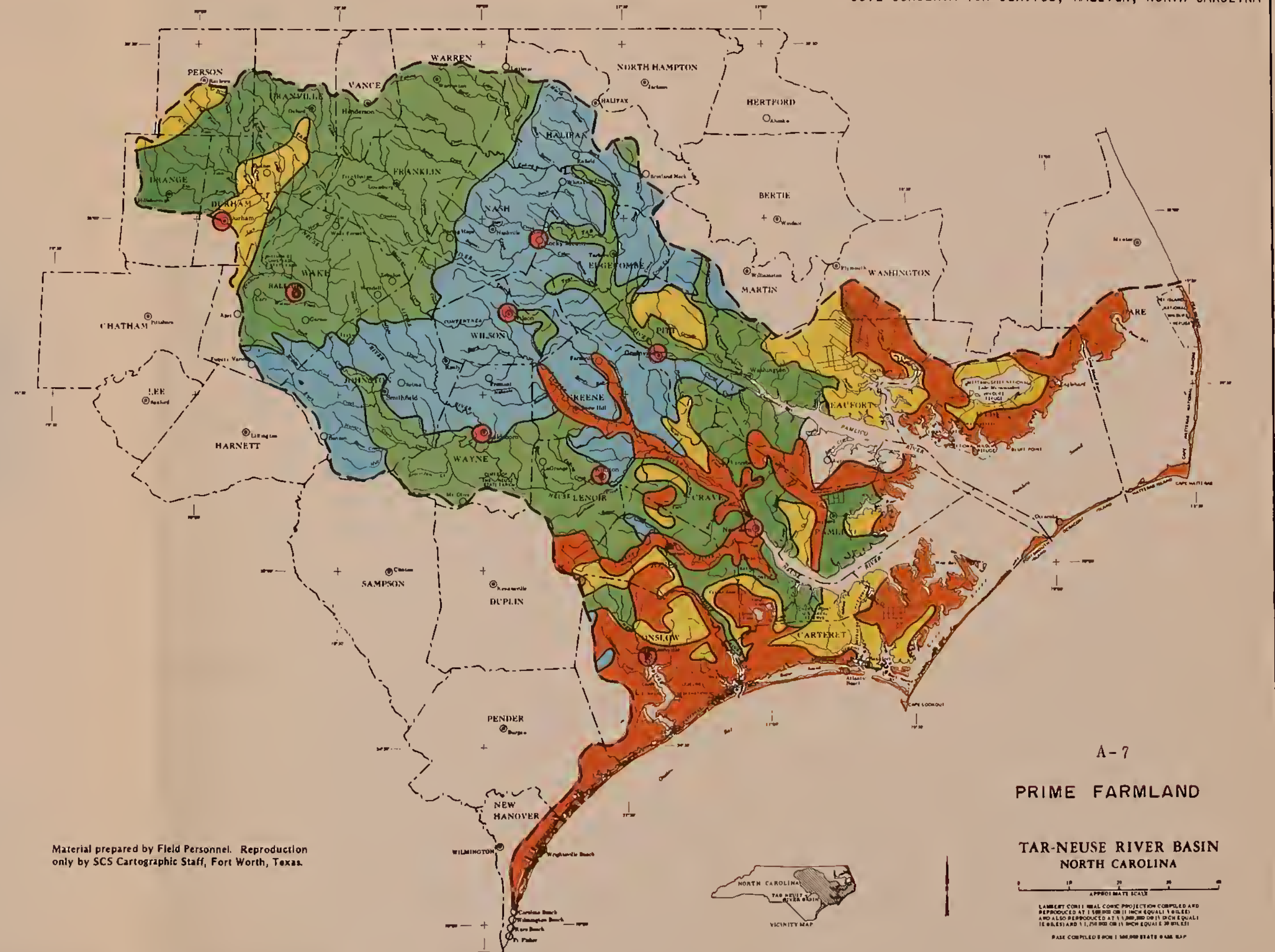
BASE COMPILED FROM 1 SOURCE STATE NAME MAP

MAY 1975 4.R.34933

REVISÉD JANUARY 1975 4-R-32018

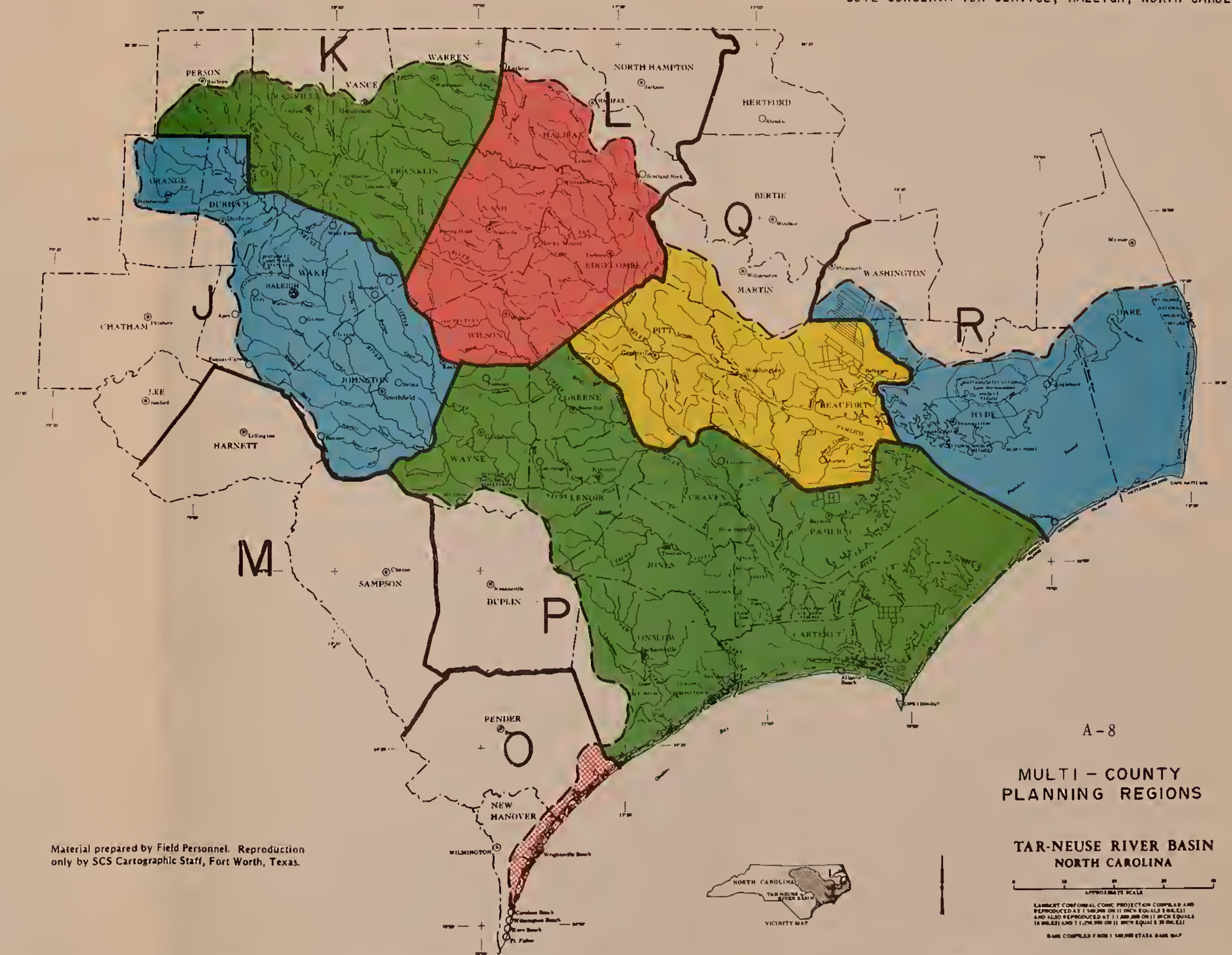












Material prepared by Field Personnel. Reproduction only by SCS Cartographic Staff, Fort Worth, Texas.

A-8  
MULTI - COUNTY  
PLANNING REGIONS

TAR-NEUSE RIVER BASIN  
NORTH CAROLINA

0 5 10  
MILES  
APPROXIMATE SCALE  
LAMBERT CONFORMAL CONIC PROJECTION COMPILAR AND  
REPRODUCED AT 1:50,000 OR 1:100,000 OR 1:250,000  
AND ALSO REPRODUCED AT 1:1,000,000 OR 1:2,500,000  
14 INCHES AND 1:1,000,000 OR 1:2,500,000  
BASE COMPILED FROM 1:50,000 SCALE BASE MAP





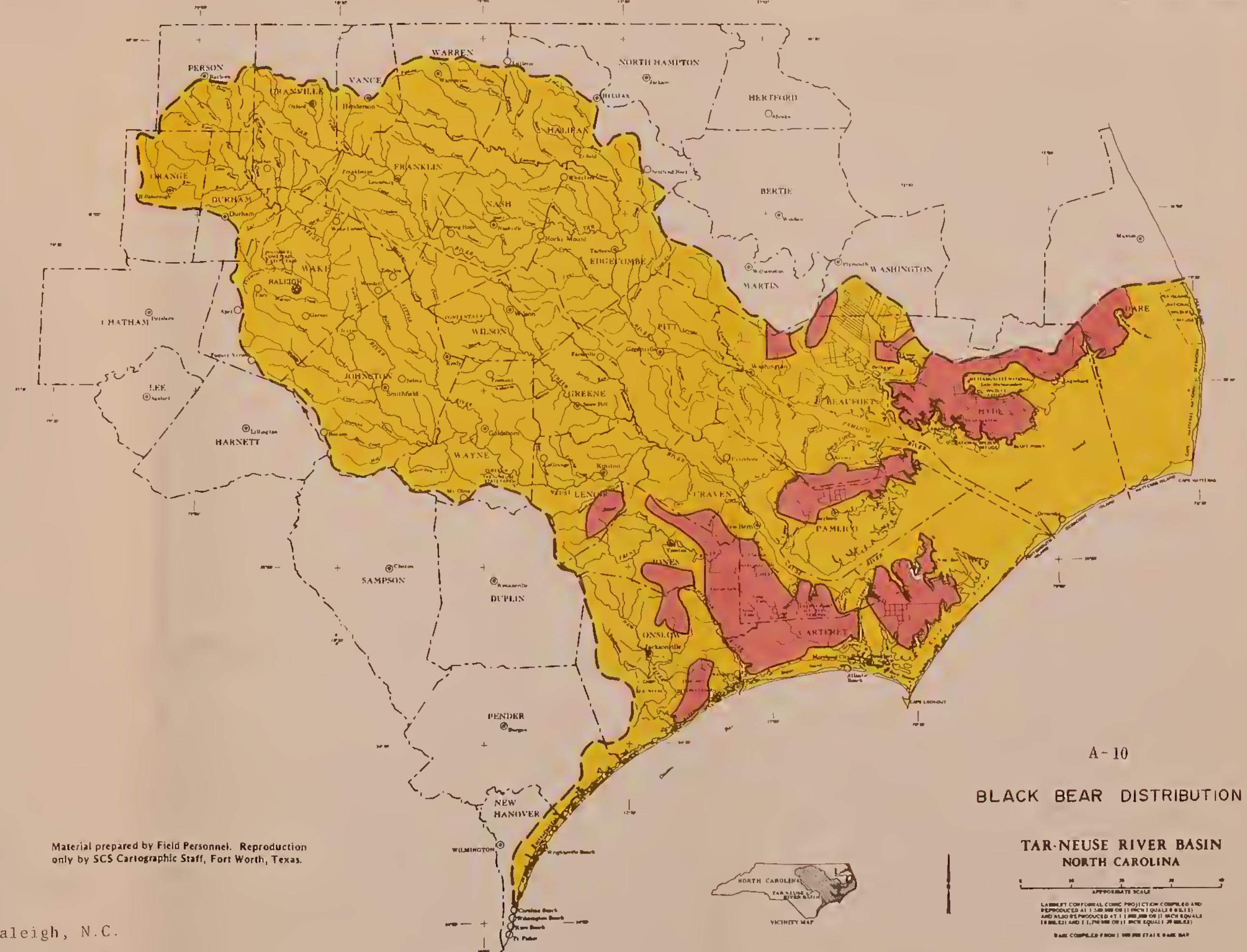
**LEGEND**

**Population**

	100,000 - 109,999
	25,000 - 49,999
	10,000 - 24,999



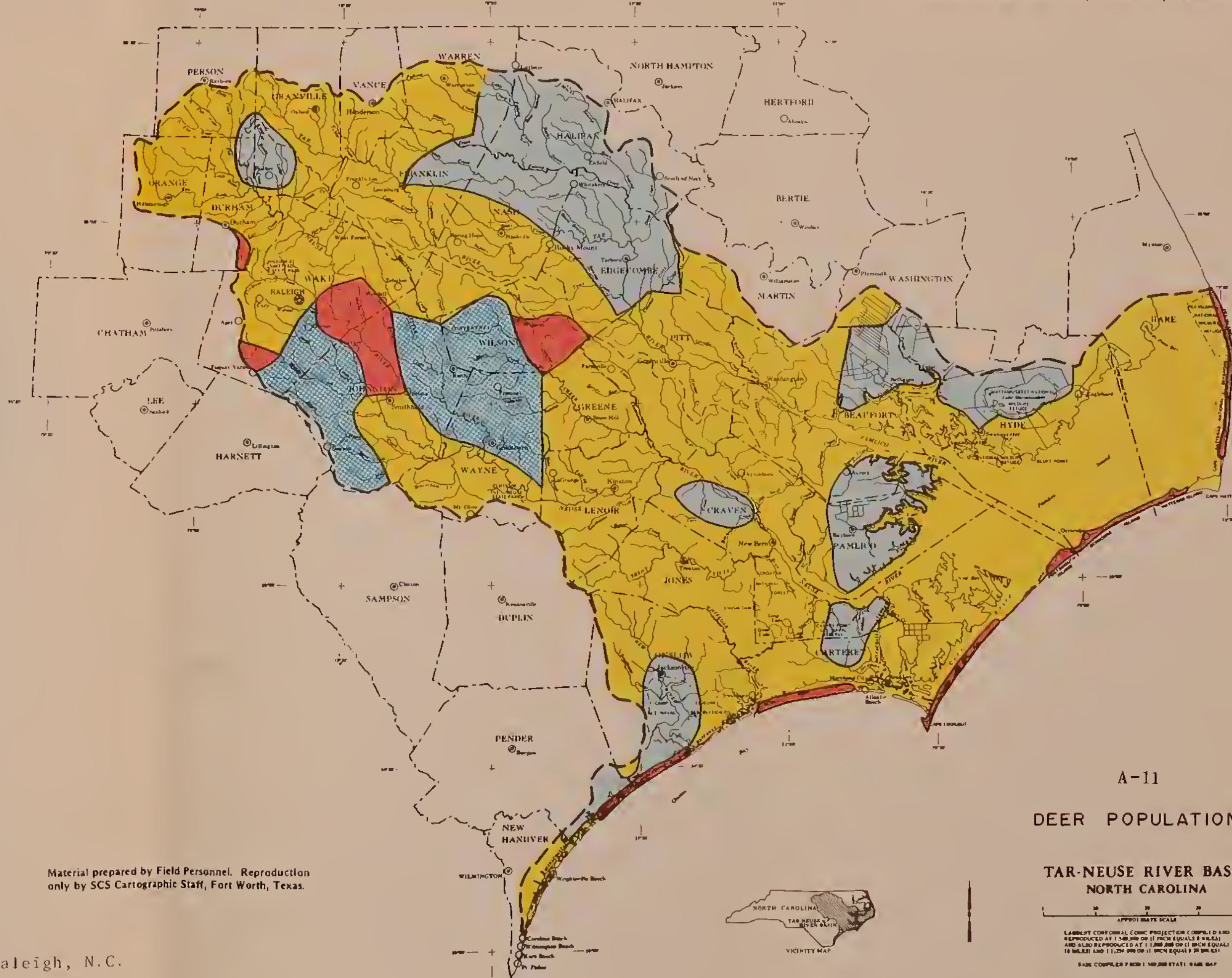




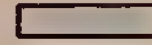



SOURCE: Barick, F.B. 1973. Hunting In North Carolina.  
North Carolina Wildlife Resources Commission, Raleigh, N.C.







LEGEND

-  HIGH DEER POPULATION, WELL ESTABLISHED HERD, UPPER LIMITS OF RANGE CAPACITY
-  MODERATE DEER POPULATION, ESTABLISHED HERD, NOT CHARACTERIZED BY SYMPTOMS OF OVERPOPULATION
-  LIGHT DEER POPULATION, SPOTTY DISTRIBUTION HERD BECOMING ESTABLISHED OR RANGE CAPACITY QUITE LOW
-  FEW, IF ANY, DEER

Material prepared by Field Personnel. Reproduction only by SCS Cartographic Staff, Fort Worth, Texas.

SOURCE: Barick, F.B. 1973. Hunting In North Carolina. North Carolina Wildlife Resources Commission, Raleigh, N.C.

A-11  
DEER POPULATION

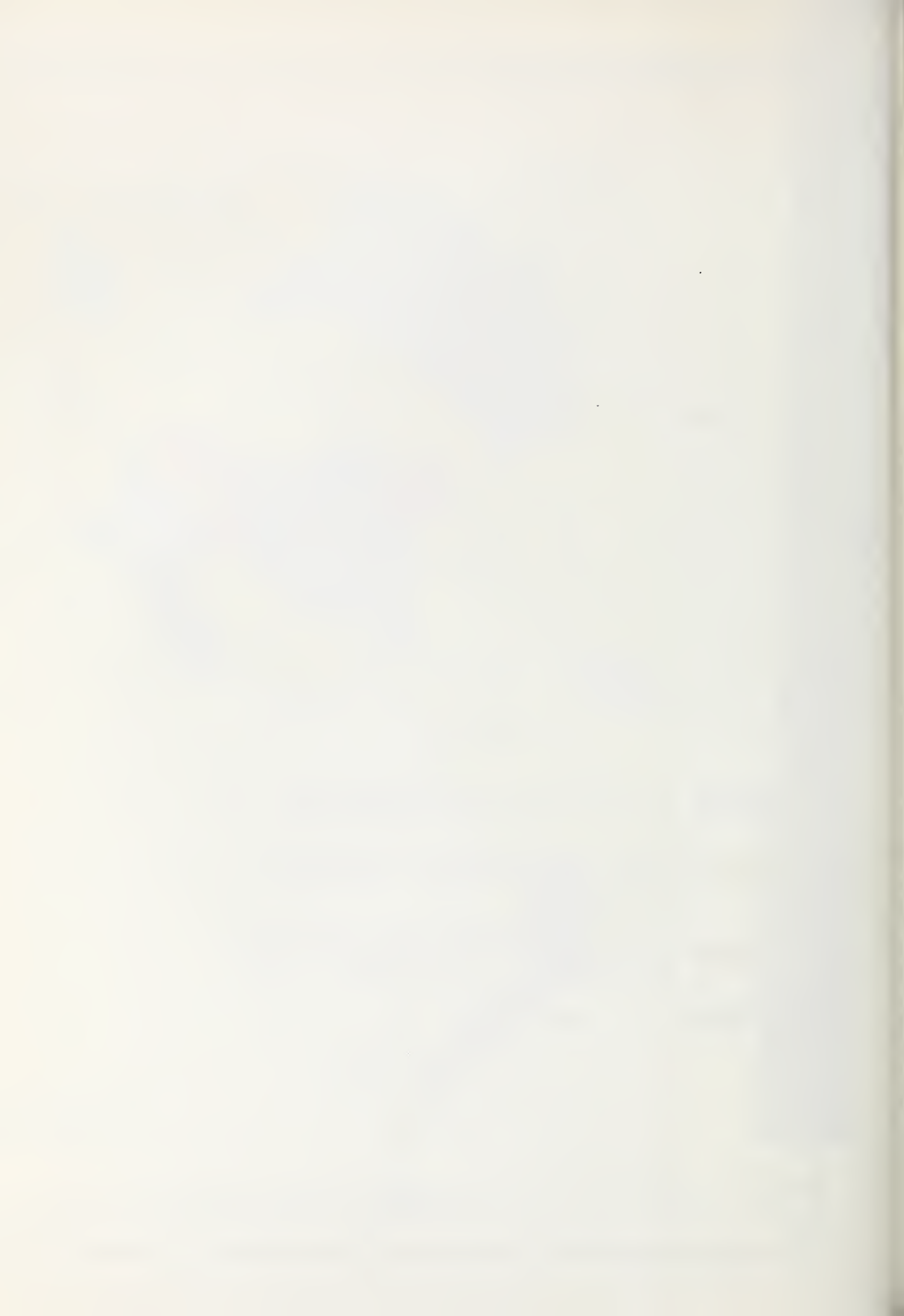
TAR-NEUSE RIVER BASIN  
NORTH CAROLINA

APPROXIMATE SCALE

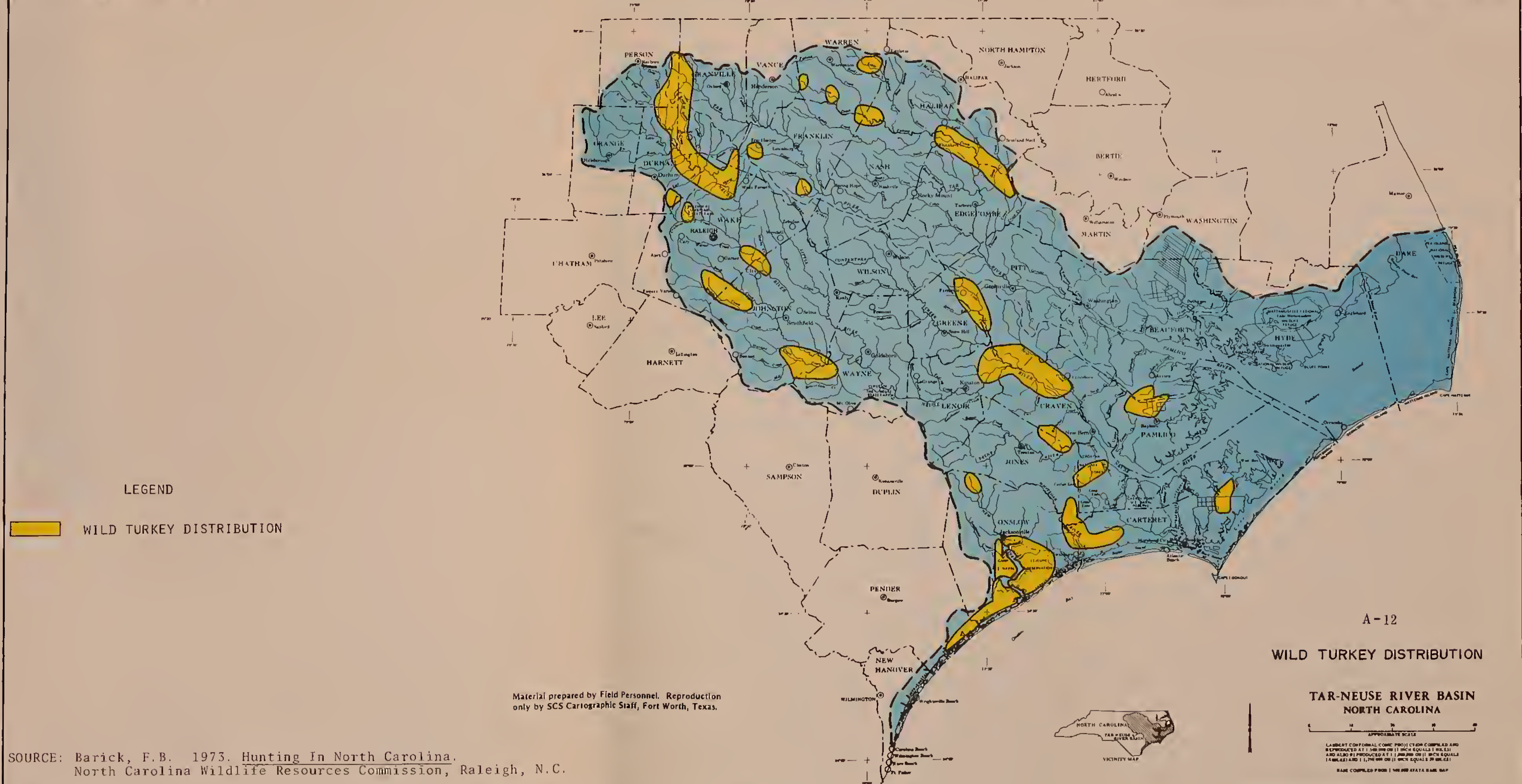
LAMBERT CONFORMAL CONIC PROJECTION COMPILED AND REPRODUCED AT 1:500,000 OR 11 INCH EQUALS 8 MILES AND ALSO REPRODUCED AT 1:1,000,000 OR 11 INCH EQUALS 16 MILES AND 1:1,250,000 OR 11 INCH EQUALS 20 MILES

BASE COMPILED FROM 1:500,000 AND 1:1,000,000



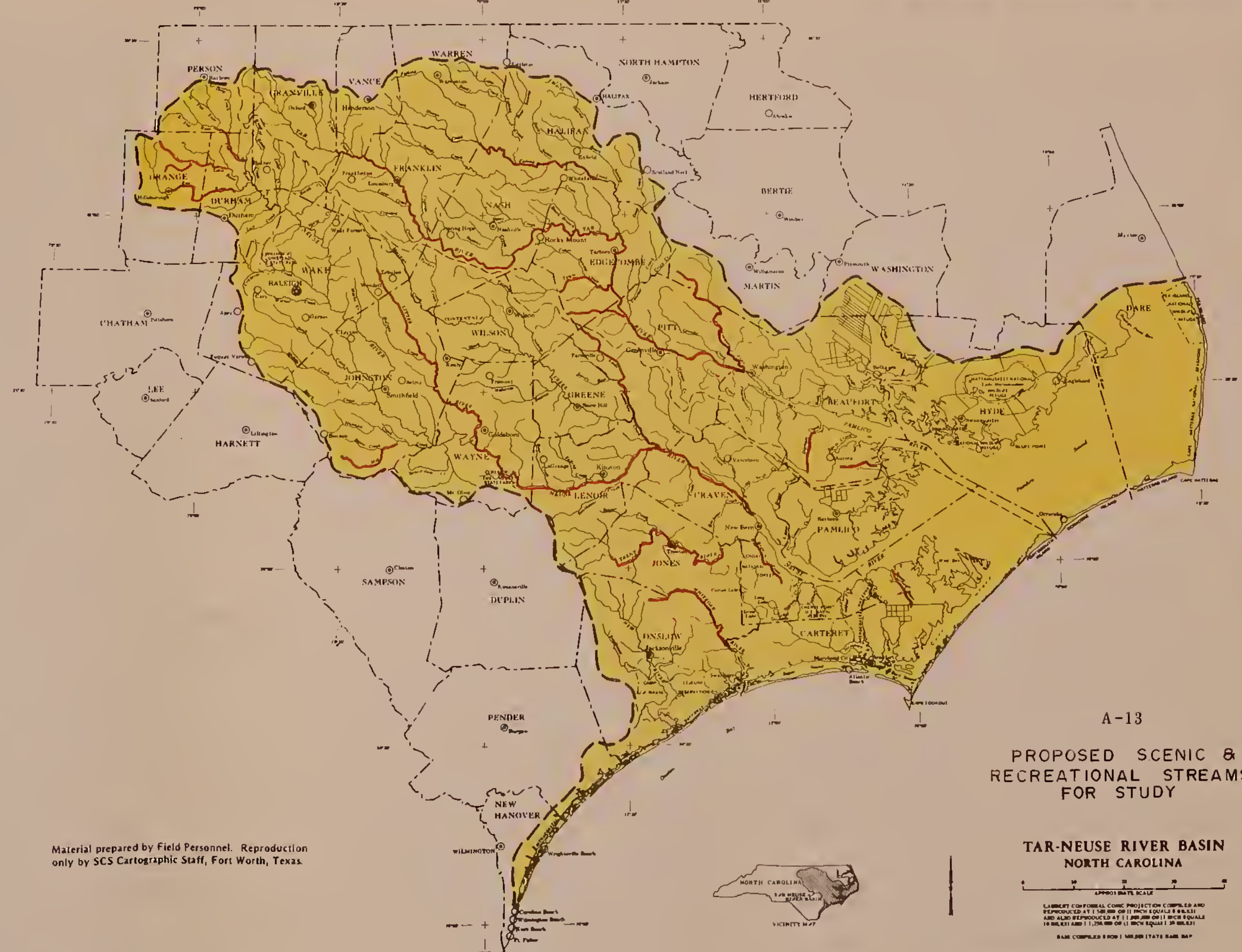










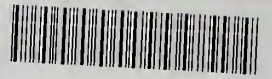








R0000 149579



R0000 149579